

ASTRONOMY  
OF THE  
SATELLITES  
OF THE

*Earth, Jupiter and Saturn:*

Grounded upon Sir *Isaac Newton's* Theory of  
the Earth's SATELLITE.

The THEORY explain'd, and made easy to the  
meanest Capacity, in calculating the true Place of  
the Moon:

And freed from the Errors printed in the said Theory, by  
Dr. *Gregory*, Dr. *Harris*, and several other Authors.

By which now the Place of the Moon, and Eclipses of the Lumina-  
ries, are found to a very great Exactness.

A L S O

New Tables of the Motions of the Satellites of *Jupi-  
ter* and *Saturn*, (founded upon the Observations of  
Mr. *Flamsteed*, Mr. *Cassini*, Mr. *Hugens*, Dr. *Halley*  
and Mr. *Pound*,) from the Vernal Equinox:

By which their Places and Positions, in respect of one ano-  
ther, may be exactly determined at any given Time.

*Adapted to the Meridian of London.*

To which is added, A PROBLEM to find the Latitude of the Place by  
the Altitude of the Sun, Moon, or Star, upon any Azimuth; being  
very useful for all Sea-faring Men, as well as Gentlemen and others.

---

By CHARLES LEADBETTER,  
*Teacher of the MATHEMATICKS.*

---

L O N D O N: a. 3632.  
Printed for J. WILCOX, at the *Green-Dragon*, in  
*Little-Britain.* M.DCC.XXIX.

## ADVERTISEMENT.

**T**HE following Mathematical Sciences are taught by the Author hereof, at his House, at *The Hand and Pen* in *Cock-Lane, Shoreditch, London*; or at any Gentleman's Apartment, viz. Vulgar and Decimal Arithmetick, Geometry apply'd to the Mensuration of Superficies and Solids, by Pen and Sliding-Rule; Projection of the Sphere on any Circle; Trigonometry, plain and spherical; Surveying of Land, by any Instrument now in Use; Gauging of all sorts of Vessels, with all the practical Methods used by the Officers of the Excise; Astronomy in all its Branches; Navigation by the Plain and Mercator's Chart, and by the Arch of a great Circle; Geography and the Use of the Globes, with all other Mathematical Instruments whatsoever. Dialling upon any Plane for any Latitude.

Where may be had, *First*, His Treatise of Eclipses for 26 Years. 2. His Sheet of the Conjunction of  $\text{h } 4$  and  $\text{♂ } 1722$ , and *Mercury's* Passage over the Sun, *October 29, 1723*. 3. His Astronomical Calendar for 28 Years, ending 1753. 4. His System of the Planets demonstrated. 5. His Sheet of all the Luminarian Eclipses for 35 Years, ending *Anno 1761*. 6. His Compleat System of Astronomy. 7. His Astronomy of the Satellites of the Earth, *Jupiter* and *Saturn*: Also sold by *J. Wilcox*, at the *Green-Dragon* in *Little-Britain, London*.





## R E A D E R,

**I** Here present you with my *Astronomy of the Satellites of the Earth, Jupiter and Saturn*. What I mean by the *Satellite of the Earth*, is the *Moon*, with Sir Isaac Newton's last *Improvement of the Theory of that Planet*, which I had published in my *Compleat System of Astronomy*, had it not been for some very gross *Errors printed in the Theory*, as laid down by Dr. Gregory, in *Pag. 334. of his Latin Astronomy*, and carried on in his *English Astronomy, Vol. II. pag. 563.* by Dr. Harris in his *Lexicon Technicum, Vol. I. under the Word Moon*: and by the *Learned Author of Prælectiones Astronomicæ, pag. 318. and in the English Translation, pag. 345.* The most material *Faults are the greatest Equation of the Apogee*, and the *radical Place for the Year 1681*. For whoever will be at the pains to examine the *Numbers (as I have done)* will find that the greatest 66782, and least 43319, *Eccentricities*, will give the greatest and least *Equations of the Lunar Orbit*  $7^{\circ} 39' 30''$ ,  $4^{\circ} 57' 56''$ ; and  $12^{\circ} 18' 15''$  for the greatest *Equation of the Apogee*, which, as they have it, is only  $12^{\circ} 15' 4''$ . By comparing these *Numbers with the Times of the visible Eclipses of the Sun in the Years 1715, 1722, 1724, 1726*, which were carefully observed at London, I am satisfied that

the greatest Equation of the Apogee is  $12^{\circ} 18' 15''$  as I have it in these my new Tables, and reduced them to the Meridian of London.

By finding the true Times of the Conjunction, and Opposition of the Sun and Moon by this Theory, it may seem, at first, to them unskill'd in these Matters, to be almost an Impossibility; but after due Consideration it will appear, that those Equations, that depend upon the Distance of the Moon from the Sun, vanish, which are the 5th, 6th and 7th; and the first, second, and third Equations, alter but little, in a small Space of Time; so that regard is chiefly to be had to the fourth Equation, with which work as I have shewed in my Compleat System, Precept 7th. until you find the Orbit-Place of the Moon the same with the Sun's true Place, and then you have the middle Time of the true Conjunction or Opposition in the Moon's Orb, to the greatest Exactness imaginable.

Many ingenious Persons have often wish'd, that Tables of the Motions of the Satellites of Jupiter and Saturn were published, that thereby they might know at any time before-hand, how they wou'd appear when observed: Therefore, for the sake of the diligent Observer, I here publish mine, constructed from the Observations of Mr. Hugen, Mr. Flamsteed, Mr. Cassini, Dr. Halley, and Mr. Pound; which, I dare to say, are the correctest the World ever saw. The Method of finding their Places is plain and easy to be understood by any one, though meanly versed in these things.

I have only one thing more to remind my Reader of, and that is, If he has a mind to find the Times of the Eclipses of Jupiter's Satellites, after the Cassinian Method, he must observe, that the periodical Time of the  
first

first Satellite is nearly  $\frac{1}{4}$  Part of the periodical Time of Jupiter from one Aphelion to another; whence the Equations of the Jovial Orbit being turned into Minutes and Seconds of Time, and adapted to those particular Revolutions of the Satellites, will make good the principal Parts of the Equations of these Satellites. By which Directions and easy Tables, any Observer may truly know their Distances from Jupiter, and distinguish one Satellite from another at any given Time; which will both be pleasant and advantageous to him in rectifying the Longitude of Places at Land, by the Times of their Eclipses.

I remain a Friend to the Astronomical Student,

CHARLES LEADBETTER.

THE



# THE CONTENTS.

## S E C T. I.

|                                                  | Pag.         |
|--------------------------------------------------|--------------|
| <b>T</b> O calculate the true Place of the Moon  | 1            |
| A Table of the first Equation of the Moon        | 3            |
| To find the second Equation of the Moon's Apogee | 4            |
| To find the first Equation of the Moon's Node    | 6            |
| To find the second Equation of the Moon          | 8            |
| To find the third Equation of the Moon           | 11           |
| To find the second Equation of the Moon's Apogee | 13           |
| To find the present Eccentricity of the Moon     | 16           |
| To find the Elliptic Equation of the Moon        | <i>ibid.</i> |
| To find the Moon's Variation                     | 18           |
| To find the sixth Equation of the Moon           | 24           |
| To find the seventh Equation of the Moon         | 25           |
| To find the Moon's Latitude and Reduction        | 26           |
| To find the Inclination of the Limit             | 28           |
| An Example of the Sun and Moon's Place           | 30           |
| A second Example of the Sun and Moon's Place     | 31           |

## S E C T. II.

|                          |    |
|--------------------------|----|
| A Problem of the Sphere. | 32 |
|--------------------------|----|

## S E C T. III.

|                                                                                                           |    |
|-----------------------------------------------------------------------------------------------------------|----|
| The Use of the Tables of the Satellites of <i>Jupiter</i> and <i>Saturn</i>                               | 36 |
| Shewing how to calculate the Distance of <i>Jupiter's</i> Satellites, and to distinguish one from another | 41 |
| A Catalogue of Observations.                                                                              | 45 |
| A Table of the mean Motion of the Moon in Years cur.                                                      | 47 |
| A Table of the mean Motion of the Moon in Months and Days, from Pag. 52, to Pag                           | 64 |
| The                                                                                                       |    |

|                                                                                                    |        |
|----------------------------------------------------------------------------------------------------|--------|
| The mean Motion of the Moon in Hours, &c.                                                          | 65     |
| A Table of the second Equation of the Node and Inclination of the Limit above $4^{\circ} 59' 35''$ | 67     |
| A Table of the Moon's simple Latitude                                                              | 68     |
| A Table of the Moon's Reduction and Excess                                                         | 69     |
| A Table of the hourly Motions, Semidiameters and Horizontal Parallaxes                             | 70, 71 |
| A Table of the Motion of the first Satellite of Jupiter                                            | 72     |
| A Table of the Motion of the second Satellite                                                      | 74     |
| A Table of the Motion of the third Satellite                                                       | 76     |
| A Table of the Motion of the fourth Satellite                                                      | 78     |
| A Table of the Distances of the Satellites of Jupiter, from his Body                               | 80     |
| A Table of the Distances of the Satellites of Jupiter, from his Body, &c.                          | 81     |
| A Table of the Motion of the first Satellite of Saturn                                             | 82     |
| A Table of the Motion of the second Satellite of $\text{h}$                                        | 84     |
| A Table of the Motion of the third Satellite of $\text{h}$                                         | 86     |
| A Table of the Motion of the fourth Satellite of $\text{h}$                                        | 88     |
| A Table of the Motion of the fifth Satellite of $\text{h}$                                         | 90     |
| A Table of the Distances of Saturn's Satellites, from his Body                                     | 92     |
| The Table continued                                                                                | 93     |
| A Table of the Number of Days from the first of January to any Day in the Year                     | 94     |
| To find the Horizontal Parallax and Appar. Semidiameter of the Moon, according to the Theory       | 95     |

( 117 )  
BOOKS just publish'd, and sold by J. Wilcox in Little Britain.

I. **A** Compleat System of Astronomy, in two Volumes; containing the Description and Use of the Sector; the Laws of Spherick Geometry; the Projection of the Sphere Orthographically and Stereographically upon the Planes of the Meridian, Ecliptic and Horizon; the Doctrine of the Sphere; and the Eclipses of the Sun and Moon for thirty-seven Years: Together with all the Precepts of Calculation. Also, new Tables of the Motions of the Planets, fix'd Stars, and the first Satellite of Jupiter; of Right and Oblique Ascensions, and of Logarithmic Logarithms. To the whole are prefix'd, Astronomical Definitions, for the Benefit of young Students. By Charles Leadbetter, Teacher of the Mathematicks. Price 12 s.

II. Astronomy, or, the true System of the Planets demonstrated: Wherein is shewn, by Instrument, their Anomalies, Heliocentric and Geocentric Places, both in Longitude and Latitude, their Aphelions, Perihelions, Retrogradation, Elongation, Parallaxes and Distances from the Sun and Earth, with the Method of computing the Times when Venus and Mercury may be seen in the Sun's Disk. Also the Moon's Phases and Eclipses of the Luminaries, for any Time past, present, or to come; with proper Cuts to each Planet, by which any Person may in a few Hours, and with great Ease, attain to a perfect Knowledge of the Planetary or Solar System. By Charles Leadbetter. Price 5 s.

III. A new Treatise of the Construction and Use of the Sector; containing the Solutions of the principal Problems, by that admirable Instrument in the chief Branches of Mathematicks, viz. Arithmetick, Mensuration, Plain Trigonometry, Projection of the Sphere, Geography, Astronomy, Dialling, &c. illustrated with Variety of necessary Observations and pleasant Conclusions; containing several Applications intirely new. By the late Mr. Samuel Cunn, now carefully revised by Edmund Stone, F. R. S. Price 4 s.

IV. A sure Guide to Builders, or the Principles and Practice of Architecture, geometrically demonstrated, and made easy for the Use of Workmen in general: Wherein such Geometrical Definitions, Theorems, Problems, &c. as are the Basis of Architecture, are render'd easy and intelligible to every Capacity, &c. By B. Langley, of Twickenham. Price 14 s.

V. The Builder's Chest-Book, or a Complete Key to the five Orders of Columns in Architecture, by way of Dialogue, very useful for young Students in Architecture. By B. Langley. Price 2 s. 6 d.

VI. The Modern Navigator's Complete Tutor, or a Treatise of the whole Art of Navigation, in its Theory and Practice, Curiosity and Utility. By Joshua Kelly. Price 4 s.



## SECTION I.

*To Calculate the true Place of the Moon, according to Sir ISAAC NEWTON'S last Improvement of his Theory.*

1. **F**ROM the Tables of the Sun's Motions in my complete System of Astronomy, calculate the true Place of the Sun, its Distance from the Earth, and Parts answering the Logarithm, and subtract the Mean Anomaly from the Mean Longitude, and you will have the Place of the Sun's Apogæum, as is shewed in the Examples for the first and second Days of January at Noon, equal Time, Anno 1729.

2. Out of these Tables of the Moon's Mean Motions, take out the Longitude, Apogee and Node, to the Equal Time of the Question proposed, and gather the Mean Longitude and Apogee into two distinct Sums; but the Mean Motion of the Node being Retrograde, you must subtract the Motions for Months and Days from the Radical Place, as is usually done, and as you see in the Examples following.

3. Before you can find any of the Moon's Equations, you must observe that these are standing Numbers, viz.

The Earth's { Eccentricity -- 1692  
Greatest Equation  $1^{\circ}56'20''$

The greatest Annual Equation } Longitude  $11^{\circ}49''$   
Apogee 20 0  
Node -- 9 30

And these four are always proportional to each other.

B

And

4. To find the first Equation of the Moon's Longitude. The Sun's Equation for the Time of the Question is  $28' 6''$ , then by the Logistical Logarithms you must always say,

|                                            |                        |       |
|--------------------------------------------|------------------------|-------|
| As $1^{\circ} 56' 20''$ the Sun's greatest | } $116' 20''$ LL. 2875 | } +   |
| Equation.                                  |                        |       |
| To its present Equation,                   | 28 6                   | 3294  |
| So D Annual greatest Equation,             | 11 49                  | 7057  |
|                                            |                        | <hr/> |
| To D first Equation in Longitude           | 2 51                   | 13226 |

Note, this Equation must always be added to the Mean Longitude of the Moon, when the Sun's Mean Anomaly is 0, 1, 2, 3, 4, 5 Signs; but must be subtracted, if the Sun's Mean Anomaly be 6, 7, 8, 9, 10, 11 Signs: from which Theory I have fram'd the following Table.

Enter the Table with the Sign on the Head and Degree of the Sun's Mean Anomaly on the Left hand descending, but with the Degree on the Right hand ascending, if the Sign fall at bottom of the Table, and in the place of meeting, you will have the first, or Annual Equation of the Moon's Longitude; which in this Example (as above) you will find to be  $2' 51''$  to be subtracted. See Gregory's *Astr.* p. 544.

A Table of the first Equation of the Moon.

| Anom. ☉ | Sign 0<br>Add.  | Sign 1<br>Add.  | Sign 2<br>Add. | Sign 3<br>Add. | Sign 4<br>Add. | Sign 5<br>Add. | Anom. ☉ |
|---------|-----------------|-----------------|----------------|----------------|----------------|----------------|---------|
| 0       | 0               | 5               | 47             | 10             | 7              | 11             | 30      |
| 1       | 0               | 12              | 5              | 10             | 14             | 11             | 29      |
| 2       | 0               | 24              | 6              | 10             | 21             | 11             | 28      |
| 3       | 0               | 36              | 6              | 10             | 26             | 11             | 27      |
| 4       | 0               | 48              | 6              | 10             | 31             | 11             | 26      |
| 5       | 1               | 0               | 6              | 10             | 37             | 11             | 25      |
| 6       | 1               | 12              | 6              | 10             | 42             | 11             | 24      |
| 7       | 1               | 24              | 6              | 10             | 47             | 11             | 23      |
| 8       | 1               | 36              | 7              | 10             | 52             | 11             | 22      |
| 9       | 1               | 48              | 7              | 10             | 56             | 11             | 21      |
| 10      | 1               | 59              | 7              | 11             | 1              | 11             | 20      |
| 11      | 2               | 11              | 7              | 11             | 5              | 11             | 19      |
| 12      | 2               | 23              | 7              | 11             | 9              | 11             | 18      |
| 13      | 2               | 35              | 7              | 11             | 14             | 11             | 17      |
| 14      | 2               | 46              | 8              | 11             | 19             | 11             | 16      |
| 15      | 2               | 58              | 8              | 11             | 22             | 11             | 15      |
| 16      | 3               | 10              | 8              | 11             | 25             | 11             | 14      |
| 17      | 3               | 22              | 8              | 11             | 28             | 11             | 13      |
| 18      | 3               | 34              | 8              | 11             | 30             | 11             | 12      |
| 19      | 3               | 46              | 8              | 11             | 32             | 11             | 11      |
| 20      | 3               | 57              | 8              | 11             | 35             | 11             | 10      |
| 21      | 4               | 9               | 9              | 11             | 38             | 11             | 9       |
| 22      | 4               | 20              | 9              | 11             | 40             | 11             | 8       |
| 23      | 4               | 32              | 9              | 11             | 42             | 10             | 7       |
| 24      | 4               | 43              | 9              | 11             | 43             | 10             | 6       |
| 25      | 4               | 54              | 9              | 11             | 45             | 10             | 5       |
| 26      | 5               | 4               | 9              | 11             | 46             | 10             | 4       |
| 27      | 5               | 15              | 9              | 11             | 47             | 10             | 3       |
| 28      | 5               | 27              | 9              | 11             | 48             | 10             | 2       |
| 29      | 5               | 37              | 10             | 11             | 48             | 10             | 1       |
| 30      | 5               | 47              | 10             | 11             | 49             | 10             | 0       |
|         | Sign 11<br>Sub. | Sign 10<br>Sub. | Sign 9<br>Sub. | Sign 8<br>Sub. | Sign 7<br>Sub. | Sign 6<br>Sub. |         |



5. To find the Annual or first Equation of the Moon's Apogee.

**B**Y remembring what the Sun's Equation is for the present Time, you must say,

|                                                |                       |       |     |
|------------------------------------------------|-----------------------|-------|-----|
| As $1^{\circ} 56' 20''$ the greatest Equation, | $116^{\circ} 20''$ LL | 2875  | } + |
| To its present Equation, -- --                 | 28 6                  | 3294  |     |
| So greatest Annual Equation Apog, 20 0         |                       | 4771  |     |
| To present Equation Apogee.                    | 4 50                  | 10940 |     |

This Equation is always to be added to the Mean Place of the Moon's Apogee, if the Sun's Mean Anomaly be 6, 7, 8, 9, 10, 11 Signs; but subtracted when the Sun's Mean Anomaly is 0, 1, 2, 3, 4, 5 Signs, as the following Table sheweth, which I have made from the Theory.

Enter the following Table with the Sun's Mean Anomaly, as directed in the 4th, and you have the Equation answering, to be added to, or subtracted from the Mean Place of the Moon's Apogee; and you will have it Equated the first time.

A Table of the first Equation of the Moon's Apogee.

| Anom. $\odot$ | Sign 0<br>Subr. | Sign 1<br>Sub.  | Sign 2<br>Sub. | Sign 3<br>Sub. | Sign 4<br>Sub. | Sign 5<br>Sub. | Anom. $\odot$ |
|---------------|-----------------|-----------------|----------------|----------------|----------------|----------------|---------------|
| 0             | 0               | 0 9 49          | 17 8 20        | 0 17 30        | 10 11 30       |                | 30            |
| 1             | 0               | 20 10 7         | 17 19 20       | 0 17 20        | 9 52 29        |                | 29            |
| 2             | 0               | 41 10 24        | 17 29 20       | 0 17 9         | 9 33 28        |                | 28            |
| 3             | 1               | 1 10 42         | 17 39 19       | 59 16 58       | 9 15 27        |                | 27            |
| 4             | 1               | 22 10 59        | 17 48 19       | 58 16 46       | 8 56 26        |                | 26            |
| 5             | 1               | 42 11 16        | 17 58 19       | 57 16 34       | 8 37 25        |                | 25            |
| 6             | 2               | 3 11 33         | 18 7 19        | 56 16 23       | 8 17 24        |                | 24            |
| 7             | 2               | 23 11 49        | 18 16 19       | 54 16 11       | 7 58 23        |                | 23            |
| 8             | 2               | 43 12 6         | 18 24 19       | 51 15 58       | 7 38 22        |                | 22            |
| 9             | 3               | 4 12 22         | 18 32 19       | 49 15 45       | 7 18 21        |                | 21            |
| 10            | 3               | 24 12 39        | 18 39 19       | 46 15 32       | 6 58 20        |                | 20            |
| 11            | 3               | 44 12 55        | 18 46 19       | 42 15 18       | 6 38 19        |                | 19            |
| 12            | 4               | 4 13 10         | 18 53 19       | 38 15 4        | 6 18 18        |                | 18            |
| 13            | 4               | 24 13 26        | 19 0 19        | 34 14 50       | 5 58 17        |                | 17            |
| 14            | 4               | 44 13 41        | 19 6 19        | 30 14 36       | 5 38 16        |                | 16            |
| 15            | 5               | 4 13 56         | 19 12 19       | 25 14 21       | 5 17 15        |                | 15            |
| 16            | 5               | 24 14 10        | 19 18 19       | 20 14 6        | 4 56 14        |                | 14            |
| 17            | 5               | 44 14 25        | 19 23 19       | 14 13 51       | 4 35 13        |                | 13            |
| 18            | 6               | 3 14 39         | 19 28 19       | 8 13 35        | 4 14 12        |                | 12            |
| 19            | 6               | 23 14 53        | 19 33 19       | 2 13 20        | 3 54 11        |                | 11            |
| 20            | 6               | 43 15 7         | 19 37 18       | 55 13 4        | 3 33 10        |                | 10            |
| 21            | 7               | 2 15 21         | 19 41 18       | 48 12 48       | 3 12 9         |                | 9             |
| 22            | 7               | 21 15 33        | 19 44 18       | 41 12 31       | 2 51 8         |                | 8             |
| 23            | 7               | 40 15 46        | 19 48 18       | 33 12 15       | 2 30 7         |                | 7             |
| 24            | 7               | 59 15 58        | 19 51 18       | 25 11 58       | 2 8 6          |                | 6             |
| 25            | 8               | 18 16 11        | 19 53 18       | 18 11 41       | 1 46 5         |                | 5             |
| 26            | 8               | 36 16 23        | 19 55 18       | 8 11 23        | 1 25 4         |                | 4             |
| 27            | 8               | 54 16 35        | 19 57 17       | 59 11 5        | 1 4 3          |                | 3             |
| 28            | 9               | 13 16 46        | 19 58 17       | 50 10 47       | 0 43 2         |                | 2             |
| 29            | 9               | 31 16 57        | 19 59 17       | 40 10 29       | 0 21 1         |                | 1             |
| 30            | 9               | 49 17 8         | 20 0 17        | 30 10 11       | 0 0 0          |                | 0             |
|               | Sign 11<br>Add. | Sign 10<br>Add. | Sign 9<br>Add. | Sign 8<br>Add. | Sign 7<br>Add. | Sign 6<br>Add. |               |

6. To find the Annual or first Equation of the Moon's Node.

**H**ere you must take the present Equation of the Sun and by the Logistical Logarithms in my Astronomy, say,

|                                            |           |                  |   |
|--------------------------------------------|-----------|------------------|---|
| As $1^{\circ} 56' 20''$ the Sun's greatest | Equation, | 116' 20" LL-2875 | } |
| To its present Equation,                   | 28 6      | 3294             |   |
| So greatest Equation of the Node,          | 9 30      | 8004             |   |

To the present Equat. of the Node, 2 18 14173

This Equation is always to be added to the Mean Place of the Node, if the Sun's Mean Anomaly be 0, 1, 2, 3, 4, 5 Signs, but subtracted if it be 6, 7, 8, 9, 10, 11 Signs, the Sum or Difference is the Place of the Node the first time Equated.



A Table of the Annual, or first Equation of the Moon's Node.

| Anom. $\odot$ | Sign 0<br>Add.  | Sign 1<br>Add.  | Sign 2<br>Add. | Sign 3<br>Add. | Sign 4<br>Add. | Sign 5<br>Add. | Anom. $\odot$ |
|---------------|-----------------|-----------------|----------------|----------------|----------------|----------------|---------------|
| 0             | 0 0             | 4 40            | 8 9            | 9 30           | 8 19           | 4 50           | 30            |
| 1             | 0 9             | 4 48            | 8 14           | 9 30           | 8 14           | 4 41           | 29            |
| 2             | 0 19            | 4 57            | 8 19           | 9 30           | 8 9            | 4 32           | 28            |
| 3             | 0 29            | 5 5             | 8 24           | 9 30           | 8 4            | 4 23           | 27            |
| 4             | 0 39            | 5 13            | 8 28           | 9 29           | 7 58           | 4 14           | 26            |
| 5             | 0 48            | 5 21            | 8 32           | 9 29           | 7 53           | 4 5            | 25            |
| 6             | 0 58            | 5 29            | 8 36           | 9 28           | 7 48           | 3 56           | 24            |
| 7             | 1 8             | 5 37            | 8 40           | 9 27           | 7 42           | 3 47           | 23            |
| 8             | 1 18            | 5 45            | 8 44           | 9 26           | 7 35           | 3 38           | 22            |
| 9             | 1 27            | 5 53            | 8 48           | 9 25           | 7 29           | 3 29           | 21            |
| 10            | 1 37            | 6 0             | 8 52           | 9 24           | 7 23           | 3 19           | 20            |
| 11            | 1 46            | 6 8             | 8 55           | 9 22           | 7 16           | 3 9            | 19            |
| 12            | 1 56            | 6 15            | 8 58           | 9 20           | 7 9            | 2 59           | 18            |
| 13            | 2 5             | 6 22            | 9 2            | 9 18           | 7 3            | 2 50           | 17            |
| 14            | 2 15            | 6 30            | 9 5            | 9 16           | 6 56           | 2 40           | 16            |
| 15            | 2 24            | 6 37            | 9 7            | 9 14           | 6 49           | 2 30           | 15            |
| 16            | 2 34            | 6 44            | 9 10           | 9 12           | 6 42           | 2 20           | 14            |
| 17            | 2 43            | 6 50            | 9 12           | 9 9            | 6 35           | 2 10           | 13            |
| 18            | 2 53            | 6 57            | 9 15           | 9 6            | 6 27           | 2 0            | 12            |
| 19            | 3 2             | 7 4             | 9 17           | 9 3            | 6 20           | 1 50           | 11            |
| 20            | 3 11            | 7 11            | 9 19           | 8 59           | 6 12           | 1 40           | 10            |
| 21            | 3 20            | 7 17            | 9 21           | 8 56           | 6 4            | 1 30           | 9             |
| 22            | 3 29            | 7 23            | 9 22           | 8 51           | 5 56           | 1 20           | 8             |
| 23            | 3 38            | 7 29            | 9 24           | 8 49           | 5 49           | 1 10           | 7             |
| 24            | 3 47            | 7 35            | 9 25           | 8 45           | 5 41           | 1 0            | 6             |
| 25            | 3 56            | 7 41            | 9 26           | 8 41           | 5 33           | 0 50           | 5             |
| 26            | 4 5             | 7 46            | 9 27           | 8 37           | 5 24           | 0 40           | 4             |
| 27            | 4 14            | 7 52            | 9 28           | 8 33           | 5 16           | 0 30           | 3             |
| 28            | 4 23            | 7 58            | 9 29           | 8 28           | 5 8            | 0 20           | 2             |
| 29            | 4 31            | 8 4             | 9 29           | 8 23           | 4 59           | 0 10           | 1             |
| 30            | 4 40            | 8 9             | 9 30           | 8 19           | 4 50           | 0 0            | 0             |
|               | Sign 11<br>Sub. | Sign 10<br>Sub. | Sign 9<br>Sub. | Sign 8<br>Sub. | Sign 7<br>Sub. | Sign 6<br>Sub. |               |

## 7. To find the Second Equation of the Moon.

**T**His Equation is greatest when the Sun is in the Octants, or  $45^{\circ}$  distant from the Moon's Apogee, and is then  $3' 56''$  if the Sun be in Perigeon; but only  $3' 34''$  in Apogee, and at a mean Distance from the Earth  $3' 45''$ : Therefore, subtract the Place of the Moon's Apogee the first time Equated, from the Sun's true Place, double the Remainder and say, As Radius, to Sine of that double Distance of the Sun from the Moon's Apogee; so is the Minutes and Second (reduced into Seconds) taken out of the following Table by help of the Sun's mean Anomaly, to the second Equation of the Moon in Second.

|                                          | Operation. | f. ° ' "         |
|------------------------------------------|------------|------------------|
| Sun's true Place                         | -- --      | 9 22 23 46       |
| Moon's Apogee first time Equated, sub.   | 1 7 53 51  |                  |
| <hr/>                                    |            | <hr/>            |
| Dist. Sun from Moon's Apogee,            |            | 8 14 29 55       |
| Double,                                  | — —        | 4 28 59 50       |
| Complement,                              | — —        | 1 1 00 10        |
| Now say,                                 |            | 0 " 21           |
| As Radius                                | — —        | 90 0 0 10 000000 |
| To S. double Dist. ☉ à ☾ Apog.           |            | 31 0 10 9.711874 |
| So $3' 54''$ out of the following Table, |            | 234 2.369216     |
| To the second Equation in Seconds,       |            | 120 2.081090     |

This Equation must always be added to the first Equated Place of the Moon, while her Apogee passes from the Square of the Sun to the Conjunction; but is subtracted from thence in the Transit of the Apogee from a Conjunction, to a Quadrature. That is, if the Distance of the Sun from the Moon's Apogee be

Signs  $\begin{cases} 012678 & \text{subtr.} \\ 34591011 & \text{add.} \end{cases}$

So in the Example before us, the second Equation  $2'$  is subtracted from  $25.23^{\circ} 27' 23''$ , and there remains  $25.23^{\circ} 25' 23''$  the Moon's Place equated the second time.

Note, always in your Work, reserve the Logar. Sine of the double Distance of the Sun from the ☾ Apogee; for you will have Occasion to use it in finding the ☾ present Eccentricity in the 10th Precept following.

A Table of the proportional Part of the  
second Equation of the Moon, with the  
Logarithm.

| Orano. | Eq. | Sign 0<br>Logar. | Eq.     | Sign 1<br>Logar. | Eq.    | Sign 2<br>Logar. | Orano. |
|--------|-----|------------------|---------|------------------|--------|------------------|--------|
| 0      | 214 | 2.330414         | 217     |                  | 221    |                  | 30     |
| 1      | 214 |                  | 217     |                  | 221    |                  | 29     |
| 2      | 214 |                  | 218     | 2.338456         | 221    |                  | 28     |
| 3      | 214 |                  | 218     |                  | 221    |                  | 27     |
| 4      | 214 |                  | 218     |                  | 221    |                  | 26     |
| 5      | 214 |                  | 218     |                  | 222    | 2.346353         | 25     |
| 6      | 214 |                  | 218     |                  | 222    |                  | 24     |
| 7      | 214 |                  | 218     |                  | 222    |                  | 23     |
| 8      | 215 | 2.332438         | 218     |                  | 222    |                  | 22     |
| 9      | 215 |                  | 218     |                  | 222    |                  | 21     |
| 10     | 215 |                  | 219     | 2.340444         | 222    |                  | 20     |
| 11     | 215 |                  | 219     |                  | 222    |                  | 19     |
| 12     | 215 |                  | 219     |                  | 222    |                  | 18     |
| 13     | 215 |                  | 219     |                  | 223    | 2.348305         | 17     |
| 14     | 215 |                  | 219     |                  | 223    |                  | 16     |
| 15     | 215 |                  | 219     |                  | 223    |                  | 15     |
| 16     | 216 | 2.334454         | 219     |                  | 223    |                  | 14     |
| 17     | 216 |                  | 219     |                  | 223    |                  | 13     |
| 18     | 216 |                  | 219     |                  | 223    |                  | 12     |
| 19     | 216 |                  | 220     | 2.342423         | 223    |                  | 11     |
| 20     | 216 |                  | 220     |                  | 223    |                  | 10     |
| 21     | 216 |                  | 220     |                  | 224    | 2.350248         | 9      |
| 22     | 216 |                  | 220     |                  | 224    |                  | 8      |
| 23     | 216 |                  | 220     |                  | 224    |                  | 7      |
| 24     | 217 | 2.336460         | 220     |                  | 224    |                  | 6      |
| 25     | 217 |                  | 220     |                  | 224    |                  | 5      |
| 26     | 217 |                  | 220     |                  | 224    |                  | 4      |
| 27     | 217 |                  | 221     | 2.344392         | 224    |                  | 3      |
| 28     | 217 |                  | 221     |                  | 224    |                  | 2      |
| 29     | 217 |                  | 221     |                  | 225    | 2.352182         | 1      |
| 30     | 217 |                  | 221     |                  | 225    |                  | 0      |
|        |     | Sign 11          | Sign 10 |                  | Sign 9 |                  |        |



A Table of the Proportional Part of the  
second Equation of the Moon, with the  
Logarithm, continued.

| °Ano.  | Eq. | Sign 3<br>Logar. | Eq. | Sign 4<br>Logar. | Eq. | Sign 5<br>Logar. | °Ano. |
|--------|-----|------------------|-----|------------------|-----|------------------|-------|
| 0      | 225 |                  | 228 |                  | 232 |                  | 30    |
| 1      | 225 |                  | 229 | 2.359836         | 232 |                  | 29    |
| 2      | 225 |                  | 229 |                  | 232 |                  | 28    |
| 3      | 225 |                  | 229 |                  | 233 | 2.367556         | 27    |
| 4      | 225 |                  | 229 |                  | 233 |                  | 26    |
| 5      | 225 |                  | 229 |                  | 233 |                  | 25    |
| 6      | 226 | 2.354108         | 229 |                  | 233 |                  | 24    |
| 7      | 226 |                  | 229 |                  | 233 |                  | 23    |
| 8      | 226 |                  | 229 |                  | 233 |                  | 22    |
| 9      | 226 |                  | 230 | 2.361728         | 233 |                  | 21    |
| 10     | 226 |                  | 230 |                  | 233 |                  | 20    |
| 11     | 226 |                  | 230 |                  | 234 | 2.369216         | 19    |
| 12     | 226 |                  | 230 |                  | 234 |                  | 18    |
| 13     | 226 |                  | 230 |                  | 234 |                  | 17    |
| 14     | 227 | 2.356026         | 230 |                  | 234 |                  | 16    |
| 15     | 227 |                  | 230 |                  | 234 |                  | 15    |
| 16     | 227 |                  | 230 |                  | 234 |                  | 14    |
| 17     | 227 |                  | 231 | 2.363612         | 234 |                  | 13    |
| 18     | 227 |                  | 231 |                  | 234 |                  | 12    |
| 19     | 227 |                  | 231 |                  | 235 | 2.371068         | 11    |
| 20     | 227 |                  | 231 |                  | 235 |                  | 10    |
| 21     | 227 |                  | 231 |                  | 235 |                  | 9     |
| 22     | 228 | 2.357935         | 231 |                  | 235 |                  | 8     |
| 23     | 228 |                  | 231 |                  | 235 |                  | 7     |
| 24     | 228 |                  | 231 |                  | 235 |                  | 6     |
| 25     | 228 |                  | 232 | 2.365488         | 235 |                  | 5     |
| 26     | 228 |                  | 232 |                  | 235 |                  | 4     |
| 27     | 228 |                  | 232 |                  | 336 | 2.372912         | 3     |
| 28     | 228 |                  | 232 |                  | 236 |                  | 2     |
| 29     | 228 |                  | 232 |                  | 236 |                  | 1     |
| 30     | 228 |                  | 232 |                  | 236 |                  | 0     |
| Sign 8 |     | Sign 7           |     | Sign 6           |     |                  |       |

## 8. To find the Third Equation of the Moon.

**T**His Equation depends upon the Distance of the Sun from the Moon's Nodes, and is greatest in the Octants, and is then  $47''$ , but in the Syzигias and Quadratures, nothing: Therefore from the Sun's true Place, subtract the Place of the Node first Equated, and say, As Radius, to the Sine of the double Distance of the Sun from the next Syzигia, or Quadrature, so is  $47''$ , to the Equation required.

| Operation.                  |     | s. ° ' " |    |    |           |
|-----------------------------|-----|----------|----|----|-----------|
| Sun's true Place,           | — — | 9        | 22 | 23 | 46        |
| Node first Equated subtr.   | — — | 10       | 25 | 43 | 30        |
|                             |     | <hr/>    |    |    |           |
| Dist. Sun from the Node,    |     | 10       | 26 | 40 | 16        |
| Double,                     | — — | 9        | 23 | 20 | 32        |
| Complement,                 | — — | 2        | 6  | 39 | 28        |
| Now say,                    |     | 0        | 1  | "  |           |
| As Radius                   | — — | 90       | 0  | 0  | 10.000000 |
| To S. double Dist of ☉ à ♌  |     | 66       | 39 | 28 | 9.962917  |
| So is the greatest Equation | — — | —        |    | 47 | 1.672098  |
| To the present Equation     | — — | —        |    | 43 | 1.635015  |

This Equation is added to the Moon's Place Equated the second Time, whilst the Nodes pass from the Sun's Conjunction to the Quadratures of the same; and is subtracted in the Transit from the Quadratures to Conjunction. And, according to the Theory, I have framed the following Table, which gives this Equation by Inspection.

A Table of the third Equation of the Moon.

Enter this Table with the Distance of the Sun from the Node, and you have the Equation to be apply'd according to its Title.

| ☉                         | Signs Add | Signs Add                 | Signs Add                | ☉  |
|---------------------------|-----------|---------------------------|--------------------------|----|
| ☉                         | 1         | 2                         | 3                        | ☉  |
| 0                         | 0         | 0                         | 41                       | 30 |
| 1                         | 0         | 1                         | 41                       | 29 |
| 2                         | 0         | 3                         | 42                       | 28 |
| 3                         | 0         | 5                         | 43                       | 27 |
| 4                         | 0         | 6                         | 43                       | 26 |
| 5                         | 0         | 8                         | 44                       | 25 |
| 6                         | 0         | 10                        | 44                       | 24 |
| 7                         | 0         | 11                        | 45                       | 23 |
| 8                         | 0         | 13                        | 45                       | 22 |
| 9                         | 0         | 14                        | 46                       | 21 |
| 10                        | 0         | 16                        | 46                       | 20 |
| 11                        | 0         | 17                        | 46                       | 19 |
| 12                        | 0         | 19                        | 47                       | 18 |
| 13                        | 0         | 20                        | 47                       | 17 |
| 14                        | 0         | 22                        | 47                       | 16 |
| 15                        | 0         | 23                        | 47                       | 15 |
| 16                        | 0         | 25                        | 47                       | 14 |
| 17                        | 0         | 26                        | 47                       | 13 |
| 18                        | 0         | 27                        | 47                       | 12 |
| 19                        | 0         | 29                        | 46                       | 11 |
| 20                        | 0         | 30                        | 46                       | 10 |
| 21                        | 0         | 31                        | 46                       | 9  |
| 22                        | 0         | 32                        | 45                       | 8  |
| 23                        | 0         | 34                        | 45                       | 7  |
| 24                        | 0         | 35                        | 44                       | 6  |
| 25                        | 0         | 36                        | 44                       | 5  |
| 26                        | 0         | 37                        | 43                       | 4  |
| 27                        | 0         | 38                        | 43                       | 3  |
| 28                        | 0         | 39                        | 42                       | 2  |
| 29                        | 0         | 40                        | 41                       | 1  |
| 30                        | 0         | 41                        | 41                       | 0  |
| Signs $\frac{1}{11}$ Sub. |           | Signs $\frac{4}{10}$ Sub. | Signs $\frac{1}{9}$ Sub. |    |



9. To find the Second Equation of the Moon's Apogee.

First, (as in the seventh Article hereof) if from the Sun's Place, you subtract the Place of the Apog. first Equated, the Remainder is called the Annual Argument, and in this Example is 8<sup>h</sup>. 14<sup>o</sup> 29' 55", which is demonstrated from the Theory thus:

Let T represent the Earth, TS a right Line joining the Earth and ☉; TACB, a right Line drawn from the Earth to the Place of the Moon's Apogee first Equated.

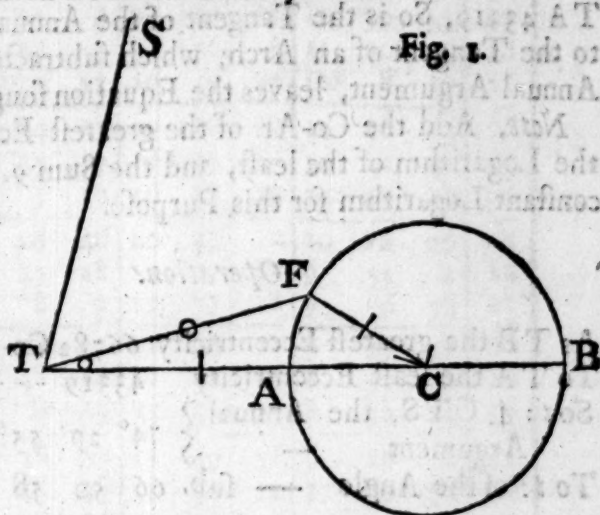


Fig. 1.

The Angle STA, the Annual Argument, of the said Apogee =  $74^{\circ} 29' 55''$ : TA the least Eccentricity 43319 of the Lunar Orbit; TB the greatest 66782. Bisect AB in C, and on the Center C, and Semidiameter AC = CB, Describe the Circle AFB; and make the Angle BCF equal to twice the Annual Argument  $148^{\circ} 59' 50''$ , and draw TF, and CF, so shall TF be the Eccentricity at the time of the Question, and the Angle CTF the Equation of the Apogee sought. In which Triangle CTF are given TC, CF, and the Angle included, being the Complement of twice the Annual Argument to a Semicircle =  $31^{\circ} 0' 10''$  to find the Angle CTF, and the Side TF.

Operation.

|                              |       |   |           |
|------------------------------|-------|---|-----------|
| TB the greatest Eccentricity | 66782 | } |           |
| TA the least Eccentricity    | 43319 |   |           |
| Difference = AB              | —     |   | 23463     |
| Half = AC = CF               | —     |   | 11731½    |
|                              |       |   | + TA = TC |
|                              |       |   | Which     |

Which falls directly under the second Axiom of plain Trigonometry; for as the Sum of the Sides  $TC + CF$ , To their Difference  $= TA$ , So is the Tangent of half the Sum of the opposite Angles, to the Tangent of half their Difference, which subtracted from half the Sum of the Angles, gives the lesser Angle, viz.  $CTF$  the Equation sought. Which in short is, As the greatest Eccentricity  $TB$  66782, Is to the least Eccentricity  $TA$  43319, So is the Tangent of the Annual Argument, to the Tangent of an Arch, which subtracted from the Annual Argument, leaves the Equation sought.

Note, Add the Co-Ar. of the greatest Eccentricity to the Logarithm of the least, and the Sum 9.812019 is a constant Logarithm for this Purpose.

### Operation.

As  $TB$  the greatest Eccentricity 66782 Co-Ar. 5.175341  
 To  $TA$  the least Eccentricity 43319 ---- 4.636678  
 So  $t: \angle CTS$ , the Annual } 74° 29' 55" 10.556970  
     Argument                — }  
 To  $t$ : of the Angle — sub. 66 50 58 10.368989  
 Rem:  $\angle CTF$ , the Equation 7 38 57

This Equation is to be added if the Annual Argument be 0, 1, 2, 6, 7 8 Signs, but subtracted if it be 3, 4, 5, 9, 10, 11, to or from the Place of the Apogee first Equated; the Sum or Difference is the Place of the Apogee a second time Equated: which in this Example is 15° 32' 48"; according to which Theory I have calculated the following Table.

A Table of the second Equation of the Moon's Apogee.

| Ann.<br>Argu. | Signs $\frac{2}{3}$ Add  |    |    | Signs $\frac{2}{3}$ Add  |    |    | Signs $\frac{2}{3}$ Add  |    |    | Ann.<br>Argu. |
|---------------|--------------------------|----|----|--------------------------|----|----|--------------------------|----|----|---------------|
|               | °                        | '  | "  | °                        | '  | "  | °                        | '  | "  |               |
| 0             | 0                        | 0  | 0  | 9                        | 28 | 8  | 11                       | 40 | 16 | 30            |
| 1             | 0                        | 21 | 4  | 9                        | 42 | 20 | 11                       | 30 | 55 | 29            |
| 2             | 0                        | 42 | 9  | 9                        | 56 | 9  | 11                       | 20 | 30 | 28            |
| 3             | 1                        | 3  | 11 | 10                       | 9  | 25 | 11                       | 8  | 59 | 27            |
| 4             | 1                        | 24 | 11 | 10                       | 22 | 10 | 10                       | 56 | 23 | 26            |
| 5             | 1                        | 45 | 7  | 10                       | 34 | 21 | 10                       | 42 | 42 | 25            |
| 6             | 2                        | 5  | 59 | 10                       | 45 | 59 | 10                       | 27 | 53 | 24            |
| 7             | 2                        | 26 | 46 | 10                       | 57 | 2  | 10                       | 12 | 00 | 23            |
| 8             | 2                        | 47 | 28 | 11                       | 7  | 29 | 9                        | 55 | 1  | 22            |
| 9             | 3                        | 8  | 3  | 11                       | 17 | 18 | 9                        | 36 | 58 | 21            |
| 10            | 3                        | 28 | 31 | 11                       | 26 | 27 | 9                        | 17 | 50 | 20            |
| 11            | 3                        | 48 | 50 | 11                       | 34 | 57 | 8                        | 57 | 38 | 19            |
| 12            | 4                        | 8  | 59 | 11                       | 42 | 45 | 8                        | 36 | 24 | 18            |
| 13            | 4                        | 28 | 59 | 11                       | 49 | 51 | 8                        | 14 | 8  | 17            |
| 14            | 4                        | 48 | 48 | 11                       | 56 | 12 | 7                        | 50 | 54 | 16            |
| 15            | 5                        | 8  | 24 | 12                       | 1  | 48 | 7                        | 26 | 41 | 15            |
| 16            | 5                        | 27 | 48 | 12                       | 6  | 37 | 7                        | 1  | 31 | 14            |
| 17            | 5                        | 46 | 58 | 12                       | 10 | 34 | 6                        | 35 | 29 | 13            |
| 18            | 6                        | 5  | 54 | 12                       | 13 | 50 | 6                        | 8  | 35 | 12            |
| 19            | 6                        | 24 | 34 | 12                       | 16 | 11 | 5                        | 40 | 49 | 11            |
| 20            | 6                        | 42 | 58 | 12                       | 17 | 40 | 5                        | 12 | 26 | 10            |
| 21            | 7                        | 1  | 4  | 12                       | 18 | 15 | 4                        | 43 | 18 | 9             |
| 22            | 7                        | 18 | 52 | 12                       | 17 | 56 | 4                        | 13 | 30 | 8             |
| 23            | 7                        | 36 | 20 | 12                       | 16 | 41 | 3                        | 43 | 7  | 7             |
| 24            | 7                        | 53 | 28 | 12                       | 14 | 29 | 3                        | 12 | 14 | 6             |
| 25            | 8                        | 10 | 15 | 12                       | 11 | 18 | 2                        | 40 | 53 | 5             |
| 26            | 8                        | 26 | 38 | 12                       | 7  | 9  | 2                        | 9  | 10 | 4             |
| 27            | 8                        | 42 | 39 | 12                       | 1  | 58 | 1                        | 37 | 9  | 3             |
| 28            | 8                        | 58 | 15 | 11                       | 55 | 46 | 1                        | 4  | 53 | 2             |
| 29            | 9                        | 13 | 24 | 11                       | 48 | 33 | 0                        | 32 | 29 | 1             |
| 30            | 9                        | 28 | 8  | 11                       | 40 | 16 | 0                        | 0  | 00 | 0             |
|               | Signs $\frac{2}{3}$ Sub. |    |    | Signs $\frac{2}{3}$ Sub. |    |    | Signs $\frac{2}{3}$ Sub. |    |    |               |



## 10. To find the present Eccentricity of the Moon.

There are in the same Triangle TCF, given as before, with the Angle CTF just now found, to find the Side TF, the present Eccentricity. *Gregory Astron. pag. 546.*

## Operation.

|                            |                          |        |          |
|----------------------------|--------------------------|--------|----------|
| As $\angle$ CTF, the Equa. | $\} 7^{\circ} 38' 57''$  | Co-Ar. | 0.875799 |
| Apog. —                    | —                        |        |          |
| To the Side CF (always     | $\} 11731\frac{1}{2}$    | -----  | 4.069354 |
| the same) —                | —                        |        |          |
| To $\angle$ TCF, Double    | $\} 31^{\circ} 00' 10''$ | -----  | 9.711874 |
| Ano Ar —                   | —                        |        |          |
| To Side TF the Eccen-      | $\} 45397$               | -----  | 4.657027 |
| tricity —                  | —                        |        |          |

## 11. To find the Mean Anomaly of the Moon.

From the Moon's Place the third time Equated, subtract the Place of the Moon's Apogee the second time Equated, and the Remainder is the Mean Anomaly of the Moon at that Time.

## Operation.

|                                            |          |    |    |       |
|--------------------------------------------|----------|----|----|-------|
|                                            | $\angle$ | 0  | '  | ''    |
| From $\angle$ place the third time Equated | 2        | 23 | 24 | 40    |
| Subtract the Place Apogee second time Equ. | 1        | 15 | 32 | 48    |
| Remains $\angle$ Mean Anomaly              | —        | 1  | 7  | 51 52 |

## 12. To find the Elliptic, or fourth Equation of the Moon.

IN the adjacent Figure make  $LB = LE$ , and join  $BE$ ; then is  $FL + LE = AP$ . Make the Angle  $AFL$  equal to the Mean Anomaly  $37^{\circ} 51' 52''$ ; The Angle  $FEL$  the true Anomaly, and the Angle  $FLE$  the Elliptic Equation being the Double of the Angle  $FBE$ .

To

To A C the Mean  
Distance of the  
Moon from the  
Earth = 1000000  
add C E = C F  
45397 the present  
Eccentricity, the  
Sum is 1045397 =  
to A E the Apoge-  
on Distance: again  
from A C 1000000  
take C E = C F  
45397 the remain-  
der is 954603 =  
A F = E P the  
Perigeon Distance.  
*Gregory's Astron.*  
Vol. 1. pag. 389.

Now say,



As the Apogeeon Distance, to the Perigeon Distance: so  
is the Tangent of half her Mean Anomaly, to the Tangent  
of half the true Anomaly; which subtracted from half the  
Mean Anomaly, and the Remainder doubled gives the  
Prosthaphæresis or Elliptic Equation sought; which is to  
be subtracted from the third Equated Place of the Moon,  
if the Mean Anomaly be 0, 1, 2, 3, 4, 5 Signs; but added, if  
it be 6, 7, 8, 9, 10, 11, the Sum or Difference is the fourth  
Equated Place of the Moon.

*Operation.*

|                                      |    |    |         |           |          |
|--------------------------------------|----|----|---------|-----------|----------|
| As A E                               | —  | —  | 1045397 | Co.-Ar.   | 3.980719 |
| To E P                               | —  | —  | 954603  | —         | 5.979822 |
|                                      |    |    | 0       |           | "        |
| So t. of half Mean Anomaly           | 18 | 55 | 56      | -         | 9.535501 |
| To t. of half the true Anomaly       | 17 | 23 | 37      | -         | 9.495842 |
| Remains the Angle F B E              | 1  | 32 | 19      |           |          |
| Doubled is = $\angle$ F L E Equation | 3  | 4  | 38      | Subtract. |          |

13. To find the Moon's Reflection, Variation, or fifth Equation. Gregory Astron. pag. 548.

**T**HE greatest Variation of the Moon is when she is in the Octants, or  $45^\circ$  distant from the Sun, and when the Sun is in Perigæum is  $37' 25''$  in seconds 2245"

|            |   |    |    |       |      |
|------------|---|----|----|-------|------|
| Apogæum is | — | 33 | 4  | ----- | 1984 |
| Difference | — | 4  | 21 | —     | 261  |

And this Difference in the Octants is made reciprocally as the Difference of the Cubes of the Distances of the Sun from the Earth. But because this way of reasoning would be very troublesome in finding the Variation answering the Sun's Distance from the Earth, I have calculated the following Table, which enter with the Sun's Mean Anomaly, and you have the Variation answering. Then from the fourth Equated Place of the Moon, subtract the true Place of the Sun, which double, and say, As Radius to Sine of the double Distance of the Moon from the Sun: so is this Variation in respect of the Sun's Distance from the Earth, to the Variation of the  $\Delta$  in respect of the  $\odot$  at that Time.

Operation.

|                          |   |   |    |   |    |       |
|--------------------------|---|---|----|---|----|-------|
| 4 Eq. pl. $\Delta$       | — | — | f. | 0 | '  | "     |
| $\odot$ place            | — | — |    | 2 | 20 | 20 2  |
|                          |   |   |    | 9 | 22 | 23 46 |
| Dist. $\Delta$ à $\odot$ | — | — |    | 4 | 27 | 56 16 |
| Double                   | — | — |    | 9 | 25 | 52 32 |
| Complement               | — | — |    | 2 | 4  | 7 28  |

|                   |   |    |                  |
|-------------------|---|----|------------------|
| Now say,          | 0 | '  | "                |
| As Radius         | — | 90 | 0 0 - 10.000000  |
| To f. Double      | — | 64 | 7 28 - 9.954119  |
| So $\odot$ Vari.  | — | -- | 2225 -- 3.347330 |
| To $\Delta$ Vari. | — | -- | 2002 -- 3.301449 |

60) 2002 (33-22

This



( 19 )

This Variation, or fifth Equation of the Moon, is to be added to the 4th Equated Place, if the Distance of the Moon from the Sun be 0, 1, 2, 6, 7, 8; but subtracted if the Distance be 3, 4, 5, 9, 10, 11 Signs, the Sum or Difference is the fifth Equated Place of the Moon.

|     | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| 00  | 0    | 12   | 24   | 36   | 48   | 60   | 72   | 84   | 96   | 108  | 120  | 132  |
| 01  | 12   | 24   | 36   | 48   | 60   | 72   | 84   | 96   | 108  | 120  | 132  | 144  |
| 02  | 24   | 36   | 48   | 60   | 72   | 84   | 96   | 108  | 120  | 132  | 144  | 156  |
| 03  | 36   | 48   | 60   | 72   | 84   | 96   | 108  | 120  | 132  | 144  | 156  | 168  |
| 04  | 48   | 60   | 72   | 84   | 96   | 108  | 120  | 132  | 144  | 156  | 168  | 180  |
| 05  | 60   | 72   | 84   | 96   | 108  | 120  | 132  | 144  | 156  | 168  | 180  | 192  |
| 06  | 72   | 84   | 96   | 108  | 120  | 132  | 144  | 156  | 168  | 180  | 192  | 204  |
| 07  | 84   | 96   | 108  | 120  | 132  | 144  | 156  | 168  | 180  | 192  | 204  | 216  |
| 08  | 96   | 108  | 120  | 132  | 144  | 156  | 168  | 180  | 192  | 204  | 216  | 228  |
| 09  | 108  | 120  | 132  | 144  | 156  | 168  | 180  | 192  | 204  | 216  | 228  | 240  |
| 10  | 120  | 132  | 144  | 156  | 168  | 180  | 192  | 204  | 216  | 228  | 240  | 252  |
| 11  | 132  | 144  | 156  | 168  | 180  | 192  | 204  | 216  | 228  | 240  | 252  | 264  |
| 12  | 144  | 156  | 168  | 180  | 192  | 204  | 216  | 228  | 240  | 252  | 264  | 276  |
| 13  | 156  | 168  | 180  | 192  | 204  | 216  | 228  | 240  | 252  | 264  | 276  | 288  |
| 14  | 168  | 180  | 192  | 204  | 216  | 228  | 240  | 252  | 264  | 276  | 288  | 300  |
| 15  | 180  | 192  | 204  | 216  | 228  | 240  | 252  | 264  | 276  | 288  | 300  | 312  |
| 16  | 192  | 204  | 216  | 228  | 240  | 252  | 264  | 276  | 288  | 300  | 312  | 324  |
| 17  | 204  | 216  | 228  | 240  | 252  | 264  | 276  | 288  | 300  | 312  | 324  | 336  |
| 18  | 216  | 228  | 240  | 252  | 264  | 276  | 288  | 300  | 312  | 324  | 336  | 348  |
| 19  | 228  | 240  | 252  | 264  | 276  | 288  | 300  | 312  | 324  | 336  | 348  | 360  |
| 20  | 240  | 252  | 264  | 276  | 288  | 300  | 312  | 324  | 336  | 348  | 360  | 372  |
| 21  | 252  | 264  | 276  | 288  | 300  | 312  | 324  | 336  | 348  | 360  | 372  | 384  |
| 22  | 264  | 276  | 288  | 300  | 312  | 324  | 336  | 348  | 360  | 372  | 384  | 396  |
| 23  | 276  | 288  | 300  | 312  | 324  | 336  | 348  | 360  | 372  | 384  | 396  | 408  |
| 24  | 288  | 300  | 312  | 324  | 336  | 348  | 360  | 372  | 384  | 396  | 408  | 420  |
| 25  | 300  | 312  | 324  | 336  | 348  | 360  | 372  | 384  | 396  | 408  | 420  | 432  |
| 26  | 312  | 324  | 336  | 348  | 360  | 372  | 384  | 396  | 408  | 420  | 432  | 444  |
| 27  | 324  | 336  | 348  | 360  | 372  | 384  | 396  | 408  | 420  | 432  | 444  | 456  |
| 28  | 336  | 348  | 360  | 372  | 384  | 396  | 408  | 420  | 432  | 444  | 456  | 468  |
| 29  | 348  | 360  | 372  | 384  | 396  | 408  | 420  | 432  | 444  | 456  | 468  | 480  |
| 30  | 360  | 372  | 384  | 396  | 408  | 420  | 432  | 444  | 456  | 468  | 480  | 492  |
| 31  | 372  | 384  | 396  | 408  | 420  | 432  | 444  | 456  | 468  | 480  | 492  | 504  |
| 32  | 384  | 396  | 408  | 420  | 432  | 444  | 456  | 468  | 480  | 492  | 504  | 516  |
| 33  | 396  | 408  | 420  | 432  | 444  | 456  | 468  | 480  | 492  | 504  | 516  | 528  |
| 34  | 408  | 420  | 432  | 444  | 456  | 468  | 480  | 492  | 504  | 516  | 528  | 540  |
| 35  | 420  | 432  | 444  | 456  | 468  | 480  | 492  | 504  | 516  | 528  | 540  | 552  |
| 36  | 432  | 444  | 456  | 468  | 480  | 492  | 504  | 516  | 528  | 540  | 552  | 564  |
| 37  | 444  | 456  | 468  | 480  | 492  | 504  | 516  | 528  | 540  | 552  | 564  | 576  |
| 38  | 456  | 468  | 480  | 492  | 504  | 516  | 528  | 540  | 552  | 564  | 576  | 588  |
| 39  | 468  | 480  | 492  | 504  | 516  | 528  | 540  | 552  | 564  | 576  | 588  | 600  |
| 40  | 480  | 492  | 504  | 516  | 528  | 540  | 552  | 564  | 576  | 588  | 600  | 612  |
| 41  | 492  | 504  | 516  | 528  | 540  | 552  | 564  | 576  | 588  | 600  | 612  | 624  |
| 42  | 504  | 516  | 528  | 540  | 552  | 564  | 576  | 588  | 600  | 612  | 624  | 636  |
| 43  | 516  | 528  | 540  | 552  | 564  | 576  | 588  | 600  | 612  | 624  | 636  | 648  |
| 44  | 528  | 540  | 552  | 564  | 576  | 588  | 600  | 612  | 624  | 636  | 648  | 660  |
| 45  | 540  | 552  | 564  | 576  | 588  | 600  | 612  | 624  | 636  | 648  | 660  | 672  |
| 46  | 552  | 564  | 576  | 588  | 600  | 612  | 624  | 636  | 648  | 660  | 672  | 684  |
| 47  | 564  | 576  | 588  | 600  | 612  | 624  | 636  | 648  | 660  | 672  | 684  | 696  |
| 48  | 576  | 588  | 600  | 612  | 624  | 636  | 648  | 660  | 672  | 684  | 696  | 708  |
| 49  | 588  | 600  | 612  | 624  | 636  | 648  | 660  | 672  | 684  | 696  | 708  | 720  |
| 50  | 600  | 612  | 624  | 636  | 648  | 660  | 672  | 684  | 696  | 708  | 720  | 732  |
| 51  | 612  | 624  | 636  | 648  | 660  | 672  | 684  | 696  | 708  | 720  | 732  | 744  |
| 52  | 624  | 636  | 648  | 660  | 672  | 684  | 696  | 708  | 720  | 732  | 744  | 756  |
| 53  | 636  | 648  | 660  | 672  | 684  | 696  | 708  | 720  | 732  | 744  | 756  | 768  |
| 54  | 648  | 660  | 672  | 684  | 696  | 708  | 720  | 732  | 744  | 756  | 768  | 780  |
| 55  | 660  | 672  | 684  | 696  | 708  | 720  | 732  | 744  | 756  | 768  | 780  | 792  |
| 56  | 672  | 684  | 696  | 708  | 720  | 732  | 744  | 756  | 768  | 780  | 792  | 804  |
| 57  | 684  | 696  | 708  | 720  | 732  | 744  | 756  | 768  | 780  | 792  | 804  | 816  |
| 58  | 696  | 708  | 720  | 732  | 744  | 756  | 768  | 780  | 792  | 804  | 816  | 828  |
| 59  | 708  | 720  | 732  | 744  | 756  | 768  | 780  | 792  | 804  | 816  | 828  | 840  |
| 60  | 720  | 732  | 744  | 756  | 768  | 780  | 792  | 804  | 816  | 828  | 840  | 852  |
| 61  | 732  | 744  | 756  | 768  | 780  | 792  | 804  | 816  | 828  | 840  | 852  | 864  |
| 62  | 744  | 756  | 768  | 780  | 792  | 804  | 816  | 828  | 840  | 852  | 864  | 876  |
| 63  | 756  | 768  | 780  | 792  | 804  | 816  | 828  | 840  | 852  | 864  | 876  | 888  |
| 64  | 768  | 780  | 792  | 804  | 816  | 828  | 840  | 852  | 864  | 876  | 888  | 900  |
| 65  | 780  | 792  | 804  | 816  | 828  | 840  | 852  | 864  | 876  | 888  | 900  | 912  |
| 66  | 792  | 804  | 816  | 828  | 840  | 852  | 864  | 876  | 888  | 900  | 912  | 924  |
| 67  | 804  | 816  | 828  | 840  | 852  | 864  | 876  | 888  | 900  | 912  | 924  | 936  |
| 68  | 816  | 828  | 840  | 852  | 864  | 876  | 888  | 900  | 912  | 924  | 936  | 948  |
| 69  | 828  | 840  | 852  | 864  | 876  | 888  | 900  | 912  | 924  | 936  | 948  | 960  |
| 70  | 840  | 852  | 864  | 876  | 888  | 900  | 912  | 924  | 936  | 948  | 960  | 972  |
| 71  | 852  | 864  | 876  | 888  | 900  | 912  | 924  | 936  | 948  | 960  | 972  | 984  |
| 72  | 864  | 876  | 888  | 900  | 912  | 924  | 936  | 948  | 960  | 972  | 984  | 996  |
| 73  | 876  | 888  | 900  | 912  | 924  | 936  | 948  | 960  | 972  | 984  | 996  | 1008 |
| 74  | 888  | 900  | 912  | 924  | 936  | 948  | 960  | 972  | 984  | 996  | 1008 | 1020 |
| 75  | 900  | 912  | 924  | 936  | 948  | 960  | 972  | 984  | 996  | 1008 | 1020 | 1032 |
| 76  | 912  | 924  | 936  | 948  | 960  | 972  | 984  | 996  | 1008 | 1020 | 1032 | 1044 |
| 77  | 924  | 936  | 948  | 960  | 972  | 984  | 996  | 1008 | 1020 | 1032 | 1044 | 1056 |
| 78  | 936  | 948  | 960  | 972  | 984  | 996  | 1008 | 1020 | 1032 | 1044 | 1056 | 1068 |
| 79  | 948  | 960  | 972  | 984  | 996  | 1008 | 1020 | 1032 | 1044 | 1056 | 1068 | 1080 |
| 80  | 960  | 972  | 984  | 996  | 1008 | 1020 | 1032 | 1044 | 1056 | 1068 | 1080 | 1092 |
| 81  | 972  | 984  | 996  | 1008 | 1020 | 1032 | 1044 | 1056 | 1068 | 1080 | 1092 | 1104 |
| 82  | 984  | 996  | 1008 | 1020 | 1032 | 1044 | 1056 | 1068 | 1080 | 1092 | 1104 | 1116 |
| 83  | 996  | 1008 | 1020 | 1032 | 1044 | 1056 | 1068 | 1080 | 1092 | 1104 | 1116 | 1128 |
| 84  | 1008 | 1020 | 1032 | 1044 | 1056 | 1068 | 1080 | 1092 | 1104 | 1116 | 1128 | 1140 |
| 85  | 1020 | 1032 | 1044 | 1056 | 1068 | 1080 | 1092 | 1104 | 1116 | 1128 | 1140 | 1152 |
| 86  | 1032 | 1044 | 1056 | 1068 | 1080 | 1092 | 1104 | 1116 | 1128 | 1140 | 1152 | 1164 |
| 87  | 1044 | 1056 | 1068 | 1080 | 1092 | 1104 | 1116 | 1128 | 1140 | 1152 | 1164 | 1176 |
| 88  | 1056 | 1068 | 1080 | 1092 | 1104 | 1116 | 1128 | 1140 | 1152 | 1164 | 1176 | 1188 |
| 89  | 1068 | 1080 | 1092 | 1104 | 1116 | 1128 | 1140 | 1152 | 1164 | 1176 | 1188 | 1200 |
| 90  | 1080 | 1092 | 1104 | 1116 | 1128 | 1140 | 1152 | 1164 | 1176 | 1188 | 1200 | 1212 |
| 91  | 1092 | 1104 | 1116 | 1128 | 1140 | 1152 | 1164 | 1176 | 1188 | 1200 | 1212 | 1224 |
| 92  | 1104 | 1116 | 1128 | 1140 | 1152 | 1164 | 1176 | 1188 | 1200 | 1212 | 1224 | 1236 |
| 93  | 1116 | 1128 | 1140 | 1152 | 1164 | 1176 | 1188 | 1200 | 1212 | 1224 | 1236 | 1248 |
| 94  | 1128 | 1140 | 1152 | 1164 | 1176 | 1188 | 1200 | 1212 | 1224 | 1236 | 1248 | 1260 |
| 95  | 1140 | 1152 | 1164 | 1176 | 1188 | 1200 | 1212 | 1224 | 1236 | 1248 | 1260 | 1272 |
| 96  | 1152 | 1164 | 1176 | 1188 | 1200 | 1212 | 1224 | 1236 | 1248 | 1260 | 1272 | 1284 |
| 97  | 1164 | 1176 | 1188 | 1200 | 1212 | 1224 | 1236 | 1248 | 1260 | 1272 | 1284 | 1296 |
| 98  | 1176 | 1188 | 1200 | 1212 | 1224 | 1236 | 1248 | 1260 | 1272 | 1284 | 1296 | 1308 |
| 99  | 1188 | 1200 | 1212 | 1224 | 1236 | 1248 | 1260 | 1272 | 1284 | 1296 | 1308 | 1320 |
| 100 | 1200 | 1212 | 1224 | 1236 | 1248 | 1260 | 1272 | 1284 | 1296 | 1308 | 1320 | 1332 |

D 2

A

A Table of the proportional Part of the  
5<sup>th</sup> Equation, or Variation of the Moon.

| Anom. ☉ | Sign 0  |    |     | Sign 1  |    |     | Sign 2 |    |     | Anom. ☉ |
|---------|---------|----|-----|---------|----|-----|--------|----|-----|---------|
|         | I       | II | III | I       | II | III | I      | II | III |         |
| 0       | 33      | 4  | 0   | 33      | 47 | 30  | 34     | 31 | 0   | 30      |
| 1       | 33      | 5  | 27  | 33      | 48 | 57  | 34     | 32 | 27  | 29      |
| 2       | 33      | 6  | 54  | 33      | 50 | 24  | 34     | 33 | 54  | 28      |
| 3       | 33      | 8  | 21  | 33      | 51 | 51  | 34     | 35 | 21  | 27      |
| 4       | 33      | 9  | 48  | 33      | 53 | 18  | 34     | 36 | 48  | 26      |
| 5       | 33      | 11 | 15  | 33      | 54 | 45  | 34     | 38 | 15  | 25      |
| 6       | 33      | 12 | 42  | 33      | 56 | 12  | 34     | 39 | 42  | 24      |
| 7       | 33      | 14 | 9   | 33      | 57 | 39  | 34     | 41 | 9   | 23      |
| 8       | 33      | 15 | 36  | 33      | 59 | 6   | 34     | 42 | 36  | 22      |
| 9       | 33      | 17 | 3   | 34      | 0  | 33  | 34     | 44 | 3   | 21      |
| 10      | 33      | 18 | 30  | 34      | 2  | 0   | 34     | 45 | 30  | 20      |
| 11      | 33      | 19 | 57  | 34      | 3  | 27  | 34     | 46 | 57  | 19      |
| 12      | 33      | 21 | 24  | 34      | 4  | 54  | 34     | 48 | 24  | 18      |
| 13      | 33      | 22 | 51  | 34      | 6  | 21  | 34     | 49 | 51  | 17      |
| 14      | 33      | 24 | 18  | 34      | 7  | 48  | 34     | 51 | 18  | 16      |
| 15      | 33      | 25 | 45  | 34      | 9  | 15  | 34     | 52 | 45  | 15      |
| 16      | 33      | 27 | 12  | 34      | 10 | 42  | 34     | 54 | 12  | 14      |
| 17      | 33      | 28 | 39  | 34      | 12 | 9   | 34     | 55 | 39  | 13      |
| 18      | 33      | 30 | 6   | 34      | 13 | 36  | 34     | 57 | 6   | 12      |
| 19      | 33      | 31 | 33  | 34      | 15 | 3   | 34     | 58 | 33  | 11      |
| 20      | 33      | 33 | 0   | 34      | 16 | 30  | 35     | 0  | 0   | 10      |
| 21      | 33      | 34 | 27  | 34      | 17 | 57  | 35     | 1  | 27  | 9       |
| 22      | 33      | 35 | 54  | 34      | 19 | 24  | 35     | 2  | 54  | 8       |
| 23      | 33      | 37 | 21  | 34      | 20 | 51  | 35     | 4  | 21  | 7       |
| 24      | 33      | 38 | 48  | 34      | 22 | 18  | 35     | 5  | 48  | 6       |
| 25      | 33      | 40 | 15  | 34      | 23 | 45  | 35     | 7  | 15  | 5       |
| 26      | 33      | 41 | 42  | 34      | 25 | 12  | 35     | 8  | 42  | 4       |
| 27      | 33      | 43 | 9   | 34      | 26 | 39  | 35     | 10 | 9   | 3       |
| 28      | 33      | 44 | 36  | 34      | 28 | 6   | 35     | 11 | 36  | 2       |
| 29      | 33      | 46 | 3   | 34      | 29 | 33  | 35     | 13 | 3   | 1       |
| 30      | 33      | 47 | 30  | 34      | 31 | 0   | 35     | 14 | 30  | 0       |
|         | Sign 11 |    |     | Sign 10 |    |     | Sign 9 |    |     |         |

Table of the Proportional Part of the 5<sup>th</sup> Equation, or Variation of the Moon, continu'd.

| Anom.<br>☉ | Sign 3 |    |     | Sign 4 |    |     | Sign 5 |    |     | Anom.<br>☉ |
|------------|--------|----|-----|--------|----|-----|--------|----|-----|------------|
|            | I      | II | III | I      | II | III | I      | II | III |            |
| 0          | 35     | 14 | 30  | 35     | 58 | 0   | 36     | 41 | 30  | 30         |
| 1          | 35     | 15 | 57  | 35     | 59 | 27  | 36     | 42 | 57  | 29         |
| 2          | 35     | 17 | 24  | 36     | 0  | 54  | 36     | 44 | 24  | 28         |
| 3          | 35     | 18 | 51  | 36     | 2  | 21  | 36     | 45 | 51  | 27         |
| 4          | 35     | 20 | 18  | 36     | 3  | 48  | 36     | 47 | 18  | 26         |
| 5          | 35     | 21 | 45  | 36     | 5  | 15  | 36     | 48 | 45  | 25         |
| 6          | 35     | 23 | 12  | 36     | 6  | 42  | 36     | 50 | 12  | 24         |
| 7          | 35     | 24 | 39  | 36     | 8  | 9   | 36     | 51 | 39  | 23         |
| 8          | 35     | 26 | 6   | 36     | 9  | 36  | 36     | 53 | 6   | 22         |
| 9          | 35     | 27 | 35  | 36     | 11 | 3   | 36     | 54 | 33  | 21         |
| 10         | 35     | 29 | 0   | 36     | 12 | 30  | 36     | 56 | 0   | 20         |
| 11         | 35     | 30 | 27  | 36     | 13 | 57  | 36     | 57 | 27  | 19         |
| 12         | 35     | 31 | 54  | 36     | 15 | 24  | 36     | 58 | 54  | 18         |
| 13         | 35     | 33 | 21  | 36     | 16 | 51  | 37     | 0  | 21  | 17         |
| 14         | 35     | 34 | 48  | 36     | 18 | 18  | 37     | 1  | 48  | 16         |
| 15         | 35     | 36 | 15  | 36     | 19 | 45  | 37     | 3  | 15  | 15         |
| 16         | 35     | 37 | 42  | 36     | 21 | 12  | 37     | 4  | 42  | 14         |
| 17         | 35     | 39 | 9   | 36     | 22 | 39  | 37     | 6  | 9   | 13         |
| 18         | 35     | 40 | 36  | 36     | 24 | 6   | 37     | 7  | 36  | 12         |
| 19         | 35     | 42 | 3   | 36     | 25 | 33  | 37     | 9  | 3   | 11         |
| 20         | 35     | 43 | 30  | 36     | 27 | 0   | 37     | 10 | 30  | 10         |
| 21         | 35     | 44 | 57  | 36     | 28 | 27  | 37     | 11 | 57  | 9          |
| 22         | 35     | 45 | 24  | 36     | 29 | 54  | 37     | 13 | 24  | 8          |
| 23         | 35     | 47 | 51  | 36     | 31 | 21  | 37     | 14 | 51  | 7          |
| 24         | 35     | 49 | 18  | 36     | 32 | 48  | 37     | 16 | 18  | 6          |
| 25         | 35     | 50 | 45  | 36     | 34 | 15  | 37     | 17 | 45  | 5          |
| 26         | 35     | 52 | 12  | 36     | 35 | 42  | 37     | 19 | 12  | 4          |
| 27         | 35     | 53 | 39  | 36     | 37 | 9   | 37     | 20 | 39  | 3          |
| 28         | 35     | 55 | 6   | 36     | 38 | 36  | 37     | 22 | 6   | 2          |
| 29         | 35     | 56 | 33  | 36     | 40 | 3   | 37     | 23 | 33  | 1          |
| 30         | 35     | 58 | 0   | 36     | 41 | 30  | 37     | 25 | 0   | 0          |
|            | Sign 8 |    |     | Sign 7 |    |     | Sign 6 |    |     |            |



Add to the Variation of the  
Moon.

| ☾<br>n.<br>○ | $f. \frac{0}{2}$ |    | $f. \frac{1}{2}$ |    | $f. \frac{2}{2}$ |    | ☾<br>n.<br>○ |
|--------------|------------------|----|------------------|----|------------------|----|--------------|
|              | '                | "  | '                | "  | '                | "  |              |
| 0            | 0                | 0  | 2                | 54 | 2                | 54 | 30           |
| 1            | 0                | 6  | 3                | 0  | 2                | 48 | 29           |
| 2            | 0                | 12 | 3                | 6  | 2                | 42 | 28           |
| 3            | 0                | 17 | 3                | 11 | 2                | 37 | 27           |
| 4            | 0                | 23 | 3                | 17 | 2                | 31 | 26           |
| 5            | 0                | 29 | 3                | 23 | 2                | 25 | 25           |
| 6            | 0                | 35 | 3                | 29 | 2                | 19 | 24           |
| 7            | 0                | 41 | 3                | 35 | 2                | 13 | 23           |
| 8            | 0                | 46 | 3                | 40 | 2                | 8  | 22           |
| 9            | 0                | 52 | 3                | 46 | 2                | 2  | 21           |
| 10           | 0                | 58 | 3                | 52 | 1                | 56 | 20           |
| 11           | 1                | 4  | 3                | 58 | 1                | 50 | 19           |
| 12           | 1                | 10 | 4                | 4  | 1                | 44 | 18           |
| 13           | 1                | 15 | 4                | 9  | 1                | 39 | 17           |
| 14           | 1                | 21 | 4                | 15 | 1                | 33 | 16           |
| 15           | 1                | 27 | 4                | 21 | 1                | 27 | 15           |
| 16           | 1                | 33 | 4                | 27 | 1                | 21 | 14           |
| 17           | 1                | 39 | 4                | 33 | 1                | 15 | 13           |
| 18           | 1                | 44 | 4                | 39 | 1                | 10 | 12           |
| 19           | 1                | 50 | 3                | 58 | 1                | 4  | 11           |
| 20           | 1                | 56 | 3                | 52 | 0                | 58 | 10           |
| 21           | 2                | 2  | 3                | 46 | 0                | 52 | 9            |
| 22           | 2                | 8  | 3                | 40 | 0                | 46 | 8            |
| 23           | 2                | 13 | 3                | 35 | 0                | 41 | 7            |
| 24           | 2                | 19 | 3                | 29 | 0                | 35 | 6            |
| 25           | 2                | 25 | 3                | 23 | 0                | 29 | 5            |
| 26           | 2                | 31 | 3                | 17 | 0                | 23 | 4            |
| 27           | 2                | 37 | 3                | 11 | 0                | 17 | 3            |
| 28           | 2                | 42 | 3                | 6  | 0                | 12 | 2            |
| 29           | 2                | 48 | 3                | 0  | 0                | 6  | 1            |
| 30           | 2                | 54 | 2                | 54 | 0                | 0  | 0            |
|              | $f. \frac{5}{2}$ |    | $f. \frac{4}{2}$ |    | $f. \frac{3}{2}$ |    |              |

A Table of the Variation or  
5<sup>th</sup> Equation.

| $\odot$ | $\frac{1}{2}$ Add. | $\frac{1}{4}$ Add. | $\frac{1}{8}$ Add. | $\odot$ |
|---------|--------------------|--------------------|--------------------|---------|
| 0       | 0                  | 28 38              | 28 38              | 30      |
| 1       | 1                  | 12 29              | 11 28              | 29      |
| 2       | 2                  | 21 29              | 43 27              | 28      |
| 3       | 3                  | 29 30              | 12 26              | 27      |
| 4       | 4                  | 37 30              | 39 26              | 26      |
| 5       | 5                  | 46 31              | 4 25               | 25      |
| 6       | 6                  | 53 31              | 27 24              | 24      |
| 7       | 7                  | 59 31              | 47 23              | 23      |
| 8       | 9                  | 7 32               | 5 22               | 22      |
| 9       | 10                 | 13 32              | 20 22              | 21      |
| 10      | 11                 | 19 32              | 34 21              | 20      |
| 11      | 12                 | 24 32              | 45 20              | 19      |
| 12      | 13                 | 27 32              | 53 19              | 18      |
| 13      | 14                 | 30 32              | 58 18              | 17      |
| 14      | 15                 | 32 33              | 3 17               | 16      |
| 15      | 16                 | 32 33              | 4 16               | 15      |
| 16      | 17                 | 32 33              | 3 15               | 14      |
| 17      | 18                 | 29 32              | 58 14              | 13      |
| 18      | 19                 | 26 32              | 53 13              | 12      |
| 19      | 20                 | 22 32              | 45 12              | 11      |
| 20      | 21                 | 15 32              | 34 11              | 10      |
| 21      | 22                 | 7 32               | 20 10              | 9       |
| 22      | 22                 | 58 32              | 5 9                | 8       |
| 23      | 23                 | 47 31              | 47 7               | 7       |
| 24      | 24                 | 34 31              | 27 6               | 6       |
| 25      | 25                 | 20 31              | 4 5                | 5       |
| 26      | 26                 | 4 30               | 39 4               | 4       |
| 27      | 26                 | 45 30              | 12 3               | 3       |
| 28      | 27                 | 25 29              | 43 2               | 2       |
| 29      | 28                 | 2 29               | 11 1               | 1       |
| 30      | 28                 | 38 28              | 38 0               | 0       |

|  $\frac{1}{2}$  Sub. |  $\frac{1}{4}$  Sub. |  $\frac{1}{8}$  Sub. |

## 14. To find the Sixth Equation of the Moon.

OUR Author fixes this Equation at a mean Quantity 2' 10". This being known; from the Moon's Apogee the second time Equated, subtract the Apogee of the Sun, and Note the Remainder.

Also from the Place of the Moon the fifth time Equated, subtract the Sun's true Place, and Note this Remainder, add these two Remainders together, and work as below.

*Operation.*

|                                          |                   |
|------------------------------------------|-------------------|
| Place Moon's Apogee second time Equated  | 1 15 32 48        |
| Place Sun's Apogee subtract              | <u>3 8 13 55</u>  |
| Remainder                                | 10 7 18 53        |
| Place of the Moon the fifth time Equated | 2 19 46 40        |
| Sun's Place subtract                     | <u>9 22 23 46</u> |
| Remainder                                | 4 27 22 54        |
| Remainder add                            | <u>10 7 18 53</u> |
| Sum of these two Remainders              | 3 4 41 47         |
| Complement                               | <u>2 25 18 13</u> |

Now say,

|                                  |          |             |
|----------------------------------|----------|-------------|
| As Radius                        | 90 80 00 | — 10.000000 |
| To Sine Z Remainders             | 85 18 13 | — 9.998339  |
| So is 2' 10" in Seconds          | 130      | — 2.113943  |
| To the Sixth Equation in Seconds | 129      | — 2.112482  |

This Sixth Equation is to be subtracted from the 5th Equated Place of the Moon, if the aforesaid Sum of the two Remainders (or its Excess above 12 Signs) be less than a Semicircle, or Six Signs; but if it is more, it must be added, the Sum or Difference is the Moon's Longitude the sixth time Equated.



## 15. To find the Seventh Equation of the Moon.

**T**His Equation Sir *Isaac Newton* has expressed by this mean Quantity  $2' 20''$ , which, he says, is encreased and diminished, according to the Situation of the Lunar Apogæum  $54''$ ; that is, if the Lunar Apogee be join'd with the Sun's Apogæum, the Equation is then  $2' 20'' + 54'' = 3' 14''$ , and also when it is in the Sun's Syzigi-  
as; but when it is in the Sun's Quadratures, the afore-  
said Equation is to be diminished  $50''$ , and he makes the  
least Quantity  $1' 26''$ , that is  $2' 20'' - 54''$ . But when the  
Moon's Apogee and Sun's are in Opposition, he cannot  
determine (for want of Observation) whether the said E-  
quation is to be encreased or diminished.

Therefore, from the sixth Equated Place of the Moon, subtract the Sun's true Place, and the Remainder is the Distance of the Moon from the Sun. Then say,

As Radius, To the Sine of this Distance of the Moon from the Sun, So is  $2' 20''$  in Seconds  $140''$ , To the Seventh Equation of the Moon: which must be subtracted from the sixth Equated Place, if the Distance of the Moon from the Sun be less than 6 Signs, but added when more; the Sum or Difference is the Moon's true Place in her Orbit.

## Operation.

|                                                      | s. | °  | '  | ''    |
|------------------------------------------------------|----|----|----|-------|
| Moon's Longitude the sixth time Equated              | 2  | 19 | 44 | 31    |
| Sun's true Place subtract                            | —  | 9  | 22 | 23 46 |
| Remains the Distance of the $\text{D} \hat{=} \odot$ | —  | 4  | 27 | 20 45 |
| Complement                                           | —  | 1  | 2  | 39 15 |

## Now say,

|                                      | °   | '  | ''          |
|--------------------------------------|-----|----|-------------|
| As Radius                            | 90  | 0  | 0—10.000003 |
| To s. Dist. $\text{D} \hat{=} \odot$ | 32  | 39 | 15—9.732045 |
| So $2' 20'' =$ Seconds               | 140 | —  | 2.146128    |
| To 1 15 the seventh Equation sub.    | 75  | —  | 1.878173    |

16. To find the Moon's Latitude, and the Reduction from her Orbit to the Ecliptic.

**F**ROM the Sun's true Place, subtract the Place of the Moon's North Node first Equated, the Remainder is called the Annual Argument of the Node.

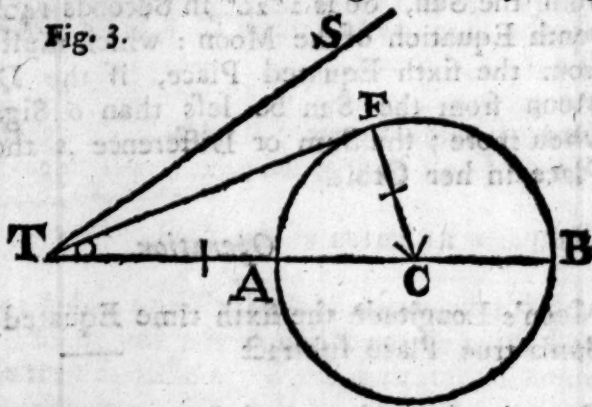
Operation.

|                                  |   |   |    |    |    |    |
|----------------------------------|---|---|----|----|----|----|
| Sun's true Place                 | — | — | 9  | 22 | 23 | 46 |
| North Node first Equated         | — | — | 10 | 25 | 43 | 30 |
| Rem. Annual Argument of the Node |   |   | 10 | 26 | 40 | 16 |
| Doubled is                       | — | — | 9  | 23 | 20 | 32 |

From this Work, and from the adjacent Figure, the second Equation of the Node is thus constructed.

Let T represent the Earth, T'S, a right Line joining the Earth and Sun: Let T A C B represent a Line drawn to the Place of the Moon's ascending Node Equated the first Time; and the Angle S T A the Annual Argument of the Node.

Fig. 3.



Let T A be taken in the same Ratio to A B as 56 to 3. Bisect B A in C, and on the Center C and Radius A C = C B draw the Circle A F B, and let the Angle B C F be equal to Double the Annual Argument in this Example  $133^{\circ} 20' 32''$  as found above; Draw T F, then will the Angle C T F be the second Equation of the Node Ascending. Now in the Oblique-Angled Plain Triangle T F C, there are known, the Sides T C, and C F, with the included

cluded Angle FCT, to find the Angle CTF the present Equation of the Node. For if TA be 56, then AB (by the Theory) is 3, and consequently  $AC = 1\frac{1}{2}$ . Therefore  $TC\ 56 + AC\ 1\frac{1}{2} = TC\ 57\frac{1}{2}$ ; then because all Lines drawn from the Center of a Circle to the Circumference thereof are equal, CF is also equal to  $AC = CB\ 1\frac{1}{2}$ , and the Angle TCF is the Complement of the Double of the Annual Argument  $66^{\circ}39'28''$  of the Node. This being the second Axiom of oblique-angled Plain Triangles. The first and second Terms in the Analogy are always the same, viz. the Sum of the Sides is ever 59, and their Difference 56: so that as the Sum of the Sides 59 is to their Difference 56, so is the Tangent of half the Sum of their opposite Angles (which is ever equal to the Annual Argument of the Node) To the Tangent of half their Difference; which subtracted from half the Sum of the two unknown Angles, leaves the lesser Angle CTF, which is the Equation of the Node.

#### Operation.

|                                        |                          |
|----------------------------------------|--------------------------|
| As the Sum of the Sides TC + CF Co-Ar. | 59—8.229148              |
| To their Difference                    | <u>56—1.748188</u>       |
| So t. of half Z opposite Angles        | 33 19 44—9.817961        |
| To t. of half their Difference         | <u>31 58 15—9.795297</u> |
| Remains Equation of the Node           | 1 21 29 Subtract.        |

This Equation is always to be added to the first Equated Place of the Node, if the Double of the Annual Argument be less than Six Signs; but subtracted, if more. Or with the Distance of the Sun from the Node enter the Table of its Equation (which I have made according to above Directions) and take out the Equation, which apply'd to the first Equated Place according to its Title gives the true Place of the Moon's Ascending Node. Note, add the Co-Ar. of the Logarithm of the two Sides, to the Logarithm of their Difference, and that Sum shall be a constant Logarithm 9.977336.



17. To find the Inclination of the Limit, Gregory  
Astron. pag. 550.

**T**HE Inclination of the Moon's Orb with the Ecliptic, when the Nodes are in the Sun's Quadratures, is  $4^{\circ} 59' 35''$ . And when they are in the Syzигias  $5^{\circ} 17' 20''$ : therefore the greatest Inclination above the least is  $17' 45''$ ; and according to this Limitation I have made the Table of Inclination of the Limit, which enter with the Annual Argument of the Node, or Distance of the Sun from the Node, which in this Example is 10 f.  $26^{\circ} 40' 16''$ , and take out the Inclination of the Limit,  $12' 26''$ .

18. From the true Place of the Moon in her Orbit, subtract the true Place of the Node last Equated, and the Remainder is the Argument of Latitude 3 f.  $25^{\circ} 21' 15''$ .

19. With the Argument of Latitude take out of the Table the simple Latitude, as also the Increment or Parts to be added, and reserve them till anon. Greg. 551.

20. Before we can find the Moon's true Latitude, we must find the proportional Part of the Increment thus. As the greatest Inclination of the Moon's Orb and Ecliptic above the least, viz.  $17' 45''$ .

To the present Increment as found by Precept 19.  
So is the present Inclination of the Limit as found by the 17, To the proportional Part of the Increment, which added to the Simple Latitude, as found by the 19, and it gives the Moon's true Latitude.

21. With the Argument of Latitude enter the Table of Reduction, and take out the Reduction, and also the Excess; then, for the proportional Part of the Excess by the Logistical Logarithms, say,

As the greatest Inclination of the Moon's Orb above the least, viz.  $17' 45''$ .

Is to the present Excess:

So is the present Inclination of the Limit as found by the 17 above,

To

To the proportional Part of the Excess, which added to the simple Reduction, gives the true.

22. According to the Title of the Table of Reduction, apply the Reduction to the Moon's Orbit Place, and you will have the Moon's true Place in the Ecliptic: as you may the better perceive by tracing the following Examples.

The

## The first Example of the Sun and Moon's Place.

| Equal Time   | Long. ☉    | Anom. ☉    |       |     |
|--------------|------------|------------|-------|-----|
|              | f. ° ' "   | f. ° ' "   |       |     |
| Anno 1729    | 9 20 56 32 | 6 12 42 37 |       |     |
| January 1    | 59 8       | 59 8       |       |     |
| Mean Mot.    | 9 21 55 40 | 6 13 41 45 | Anom. | } ☉ |
| Equat. add   | 28 6       | 9 21 55 40 | Long. |     |
| ☉ true Place | 9 22 23 46 | 3 8 13 55  | Apog. |     |

| Equal Time    | Long. ☽    | Apog. ☽                   | Node ☽         |                 |
|---------------|------------|---------------------------|----------------|-----------------|
|               | f. ° ' "   | f. ° ' "                  | f. ° ' "       |                 |
| Anno 1729     | 2 10 19 39 | 1 7 42 20                 | 10 25 48 59    |                 |
| January 1     | 13 10 35   | 6 41                      | 3 11           |                 |
| Mean Mot.     | 2 23 30 14 | 1 7 49 1                  | 10 25 45 48    |                 |
| 1 Equation    | — 2 51     | + 4 50                    | — 2 18         |                 |
| ☽ Equated 1   | 2 23 27 23 | 1 7 53 51                 | 10 25 43 30    | Node Equat.     |
| 2 Equation f. | — 2 0      | + 7 38 57                 | 9 ☉ 22 23 46   | Sun's Place.    |
| ☽ Equated 2   | 2 23 25 23 | 1 15 32 48                | 10 26 40 16    | ☉ à ☽.          |
| 3 Equation f. | — 43       | 9 ☉ 22 23 46              | 9 23 20 32     | Double.         |
| ☽ Equated 3   | 2 23 24 40 | 8 14 29 55                | 2 6 39 28      | Complement      |
| 4 Equation f. | — 3 4 38   | 4 28 59 50                | — 1 21 29      | 2d Equat. sub.  |
| ☽ Equated 4   | 2 20 20 2  | 1 1 00 10                 | 10 24 22 1     | Nod. true Pl.   |
| 5 Equation f. | — 33 22    | Eccentricity              | — — —          | 45397           |
| ☽ Equated 5   | 2 29 46 40 | Mean Anom.                | — — —          | 1 f. 7° 51' 52" |
| 6 Equation f. | — 2 9      | Inclination of the Limit, | — — —          | 12 26           |
| ☽ Equated 6   | 2 19 44 31 | Simple Latitude           | — — —          | 4 30 37         |
| 7 Equation f. | — 1 15     | Increment                 | — — —          | 16 1            |
| ☽ in her Orb. | 2 19 43 16 | Excess                    | — — —          | 36              |
| North Nod. f. | 10 24 22 1 | As the Greatest           | 17' 45" Co-Ar. | 4709            |
| Arg. Latitud. | 3 25 21 15 | To Increment              | 16 1 — —       | 5736            |
| Tr. Lat. N.D. | 4 41 50    | So Inclination            | 12 26 — —      | 6836            |
| Red. add      | + 5 29     | To Increment              | 11 13 — —      | 7281            |
| Eclipt. Place | 2 19 48 45 |                           |                |                 |



## Example 2.

| Equal Time   | Long. ☉.   | Anom. ☉.   |       |      |
|--------------|------------|------------|-------|------|
|              | f. ° ' "   | f. ° ' "   |       |      |
| Anno 1729    | 9 20 56 32 | 6 12 42 37 |       |      |
| January 2    | 1 58 17    | 1 58 17    |       |      |
| Mean Mor.    | 9 22 54 49 | 6 14 40 54 | Anom. | } ☉. |
| Equat. add   | 30 5       | 9 22 54 49 | Long. |      |
| ☉ true Plac. | 9 23 24 54 | 3 8 13 55  | Apog. |      |

| Equal Time    | Long. ♀.    | Apog. ♀.                        | Node ♀.      |                |
|---------------|-------------|---------------------------------|--------------|----------------|
|               | f. ° ' "    | f. ° ' "                        | f. ° ' "     |                |
| Anno 1729     | 2 10 19 39  | 1 7 42 20                       | 10 25 48 59  |                |
| January 2     | 26 21 10    | 13 22                           | 6 21         |                |
| Mean Mor.     | 3 6 40 49   | 1 7 55 42                       | 10 25 42 38  |                |
| 1 Equation    | — 3 3       | + 5 10                          | — 2 27       |                |
| ♂ Equated 1   | 3 6 37 46   | 1 8 0 52                        | 10 25 40 11  | Node Equat.    |
| 2 Equation f. | — 1 54      | 9 ☉ 23 24 54                    | 9 ☉ 23 24 54 | Sun's Place.   |
| ♂ Equated 2   | 3 6 35 52   | 8 15 24 2                       | 10 27 44 43  | ☉ à ♀.         |
| 3 Equation f. | — 42        | 5 0 48 4                        | 9 25 29 26   | Double.        |
| ♂ Equated 3   | 3 6 35 10   | 0 29 11 56                      | 2 4 30 34    | Complement.    |
| 4 Equation f. | — 3 55 38   | + 7 16 43                       | — 1 20 1     | 2d Equat. sub. |
| ♂ Equated 4   | 3 2 39 32   | 1 15 17 35                      | 10 24 20 10  | Nod. true Pl.  |
| 5 Equation f. | — 24 34     |                                 |              |                |
| ♂ Equated 5   | 3 2 14 58   | Eccentricity — — —              | 45 173       |                |
| 6 Equation f. | — 2 5       | Mean Anom. — — —                | 1 21 17 35   |                |
| ♂ Equated 6   | 3 2 12 53   | Simple Lat. — — —               | 3 56 21      |                |
| 7 Equation f. | — 51        | Inclination — — —               | 12 43        |                |
| ♂ in her Orb. | 3 2 12 2    | Increment — — —                 | 13 58        |                |
| North Nod. f. | 10 24 20 10 | Excess — — —                    | 0 46         |                |
| Arg. Latitud. | 4 7 51 52   | As the Greatest 17' 45" Co. Ar. | 4709         |                |
| Tr. Lat. N.D. | 4 6 22      | To Excess — 0 46 — —            | 18935        |                |
| Reduct. add   | + 6 53      | So Inclinat. — 12 43 — —        | 6738         |                |
| Eclipt. Place | 3 2 18 55   | To Excess add 0 33 — —          | 20382        |                |

## SECTION II.

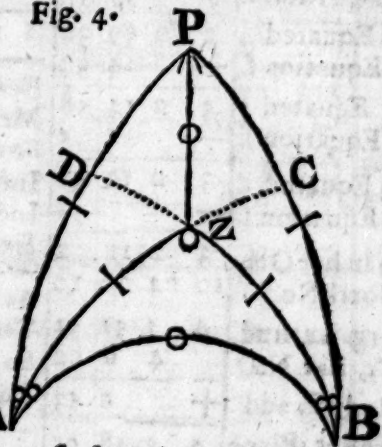
*A Problem of the Sphere.*

**GIVEN**, Two Altitudes of the Sun upon any Azimuth, with the Time between them, to find the Latitude of the Place.

*Example*, Suppose *July 17*, at  $10\frac{1}{2}$  in the Forenoon, I observe the Sun's Altitude  $52^{\circ} 59'$ ; and at 2 in the Afternoon the same Day I observe it  $49^{\circ} 51'$ ; What is the Latitude of the Place of Observation?

In the following Figure, A represents the Time and Place of the first Observation, B the second, P the North Pole, Z the Zenith, in which Triangles are given, AP  $70^{\circ} 58'$  the Complement of the Sun's Declination, or its Distance from the North Pole, at the Time of the first Observation; BP  $71^{\circ} 1'$  the Sun's Distance from the North Pole at the Time of the second Observation, with the included Angle at P, viz. APB,  $52^{\circ} 30'$  the Time between the two Observations: Also in the Triangle AZB, there are given AZ  $37^{\circ} 1'$  the

Fig. 4.



Complement of the Sun's Altitude, or its Distance from the Zenith at the Time of the first Observation, and BZ  $40^{\circ} 9'$  the Complement of the Sun's Altitude at the Time of the second Observation, to find ZP the Distance of the Zenith from the Pole equal to the Complement of the Latitude of the Place of Observation. But before we can find ZP, we must find the Side AB, and the Angles at A and B. This may be effected two Ways; first, as I have shewed in Problem

blem 16 of my Doctrine of the Sphere: The other Way is wrought by the versed Sine, as I shall shew following. First in the Triangle A P B, to find the Side A B. This may be done by letting fall a Perpendicular from the Angle A upon B P, as A C; or else B D from the Angle B upon the Side A P, for both will produce the same Thing.

*Operation.*

|                      |   |    |    |         |           |
|----------------------|---|----|----|---------|-----------|
| As C. P B            | — | 71 | 1  | —       | 9.536561  |
| To Radius            | — | 90 | 0  | —       | 10.000000 |
| So C. $\angle$ D P B | — | 52 | 30 | —       | 9.784447  |
| To $\angle$ D P      | — | 60 | 32 | —       | 10.247886 |
| From A P             | — | 70 | 58 |         |           |
| Remains A D          | — | 10 | 26 |         |           |
| As C. D P            | — | 60 | 32 | Co. Ar. | 0.308108  |
| To C. A D            | — | 10 | 26 | —       | 9.992759  |
| To C. B P            | — | 71 | 1  | —       | 9.512275  |
| To C. A B            | — | 49 | 26 | —       | 9.813142  |

Or by letting fall the Perpendicular A C

|                      |   |    |    |         |           |
|----------------------|---|----|----|---------|-----------|
| As C. A P            | — | 70 | 58 | —       | 9.537792  |
| To Radius            | — | 90 | 0  | —       | 10.000000 |
| So C. $\angle$ A P C | — | 52 | 30 | —       | 9.784447  |
| To $\angle$ P C      | — | 60 | 28 | —       | 10.246655 |
| From P B             | — | 71 | 1  |         |           |
| Remains C B          | — | 10 | 33 |         |           |
| As C. P C            | — | 60 | 28 | Co. Ar. | 0.307242  |
| To C. C B            | — | 10 | 33 | —       | 9.992596  |
| So C. A P            | — | 70 | 58 | —       | 9.513375  |
| To C. A B            | — | 49 | 26 | —       | 9.813213  |

Secondly, by the Tables of Versed Sines.

To solve this Case without the Help of the Perpendicular, has been long since hinted by *Gunter*, *Speidel*, *Gellibrand*, and *Collins*; (see *Collins's Sector on a Quadrant*, Pag. 88.) and since them by *Sir Jonas Moore*, *Harris*, &c.



*Rule.* As the Cube of the Radius, Is to the Rectangle of the Sines of the Comprehending Sides:

So is the Square of the Sine of half the Angle contain'd, To half the Difference of the versed Sines of the Third, and of the Ark of Difference between the two including Sides. Which is thus:

Double the Logarithm Sine of half the Angle given, and thereto add the Logarithm Sines of the contain'd Sides, and from the Left-hand of the Sum, dash out or reject 3, for the Cube of the Radius, so there rests the Logarithm of half the Difference of those two versed Sines, which half Difference doubled and added to the versed Sine of the Difference of the Logarithms of the containing Sides, gives the N. versed Sine of the Side sought.

### Operation.

|                     |                    |                     |             |           |
|---------------------|--------------------|---------------------|-------------|-----------|
| Given Angle A P B   | 52° 30'            | { half = 26° 15' }  | Double Sine | 19.291412 |
| Given Sides         | { A P 70 58 - Sine | —                   | 9.975583    |           |
|                     | { B P 71 1 - Sine  | —                   | 9.975713    |           |
| Sum is f. of        | 10 4               |                     |             | 9.242708  |
| Natural Sine of     | 10 4               | is                  |             | 1747939   |
| Doubled is          |                    |                     |             | 3495878   |
| Diff. of the Sides  | 0 3                | Versed Sine is add. |             | 4         |
| Sum is N. Versed f. | 49 26              | = Side A B          |             | 3495882   |

Secondly, for the Angle A B P.

|               |         |        |          |                                                                           |
|---------------|---------|--------|----------|---------------------------------------------------------------------------|
| As f. A B     | - 49 26 | Co-Ar. | 0.119387 | } Or it may be found by the 9th Problem of my Doctrine of the Sphere, &c. |
| To f. ∠ A P B | 52 30   | - - -  | 9.899467 |                                                                           |
| So f. A P     | 70 58   | - - -  | 9.975583 |                                                                           |
| To f. ∠ A B P | 80 51   | - - -  | 9.994437 |                                                                           |

3. For the Angle B A P.

|                    |                  |        |          |
|--------------------|------------------|--------|----------|
| As $f. AB$         | $49^{\circ} 26'$ | Co-Ar. | 0.119387 |
| To $f. \angle APB$ | $52^{\circ} 30'$ | ---    | 9.899467 |
| So $f. PB$         | $71$             | ---    | 9.975713 |
| To $f. \angle BAP$ | $80^{\circ} 57'$ | ---    | 9.994567 |

4. For the Angle Z A B. By Prob. 9. of my Astron.

|                                        |                      |                  |                      |
|----------------------------------------|----------------------|------------------|----------------------|
| Side subtend. the required $\angle ZB$ | $40^{\circ} 9'$      | $AB$             | $49^{\circ} 26'$     |
|                                        | $\frac{1}{2} 20$     | $4\frac{1}{2}$   | $AZ$ $37^{\circ} 1'$ |
|                                        | $\frac{1}{2} 6$      | $12\frac{1}{2}$  |                      |
|                                        |                      | $X$              | $12^{\circ} 25'$     |
|                                        | $Z$ $26^{\circ} 17'$ | $\frac{1}{2} 6$  | $12\frac{1}{2}$      |
|                                        | $X$                  | $13^{\circ} 52'$ |                      |

|                |                  |              |           |
|----------------|------------------|--------------|-----------|
| $f. AZ$        | $37^{\circ} 1'$  | Co-Ar.       | 0.220369  |
| $f. AB$        | $49^{\circ} 26'$ | Co-Ar.       | 0.119387  |
| $f. Z$         | $26^{\circ} 17'$ | ---          | 9.646218  |
| $f. X$         | $13^{\circ} 52'$ | ---          | 9.372601  |
| Sum Logarithms |                  |              | 19.365575 |
| Sine           | $28^{\circ} 48'$ |              | 9.6827875 |
| Double is      | $57^{\circ} 36'$ | $\angle ZAB$ | sub.      |
| $BAP$          | $80^{\circ} 57'$ | from         |           |

$ZAP$   $23^{\circ} 21'$  Rem.

5. For the Angle Z B A.

|                              |  |          |                  |                 |                       |
|------------------------------|--|----------|------------------|-----------------|-----------------------|
| Side subtending the required |  | $\angle$ | $37^{\circ} 1'$  | $BZ$            | $40^{\circ} 9'$       |
| Angle is $AZ$                |  |          | $\frac{1}{2} 18$ | $30\frac{1}{2}$ | $BA$ $49^{\circ} 26'$ |
|                              |  |          | $\frac{1}{2} 4$  | $38\frac{1}{2}$ |                       |
|                              |  |          |                  | $X$             | $9^{\circ} 17'$       |
|                              |  | $Z$      | $23^{\circ} 9'$  | $\frac{1}{2} 4$ | $38\frac{1}{2}$       |
|                              |  | $X$      | $13^{\circ} 52'$ |                 |                       |

F 2

C B Z

|                     |       |         |              |                                                                                              |
|---------------------|-------|---------|--------------|----------------------------------------------------------------------------------------------|
| <i>f</i> BZ         | 40 9  | Co-Ar.  | - - 0.190581 | } The three Angles<br>at the Zenith are<br>thus;<br>AZP 143° 0'<br>BZP 132 56<br>AZB 9 84 14 |
| <i>f</i> .BA        | 49 26 | Co-Ar.  | - - 0.119387 |                                                                                              |
| <i>f</i> .Z         | 23 9  | - - - - | - 9.594547   |                                                                                              |
| <i>f</i> .X         | 13 52 | - - - - | - 9.379601   |                                                                                              |
| Z of the Logarithms | - -   | - -     | 19.284116    |                                                                                              |
| Sine of             | 26 1  | - - - - | - 9.642058   |                                                                                              |

Double  $52 \quad 2 = \angle ZBA.$  Z 360 00  
 ABP 80 51 Proves the work right.

ZBP 28 49

6. Lastly, for the Side ZP, being the Complement of the Latitude of the Place of Observation.

|                            |       |        |            |   |
|----------------------------|-------|--------|------------|---|
| As <i>f</i> . $\angle ZPB$ | 30° 0 | Co-Ar. | 0.301029   | } |
| To <i>f</i> . — ZB         | 40 9  | - - -  | - 9.809419 |   |
| So <i>f</i> . $\angle ZBP$ | 28 49 | - - -  | - 9.683055 |   |
| To <i>f</i> . — ZP         | 38 26 | - - -  | - 9.793503 |   |
| From —                     | 90 0  | - - -  | - 9.954282 |   |
| Remains —                  | 51 34 | - - -  | - 9.690782 |   |

Remains — 51 34, the Latitude of the Place North.

And thus may the Latitude of the Place be found without the Meridian Altitude, by taking the Sun's Altitude twice in the Forenoon, or twice in the Afternoon; or by the Moon alone, or by the Moon and any Star, or else by the Altitude of two fixed Stars or Planets, for their Difference of right Ascensions shall be the Angle at the Pole; and then the Things given and required in the Triangle, are the same as above, which needs no Example.

### S E C T. III.

*The Use of the Tables of the Satellites of Jupiter and Saturn.*

**T**HIS Part of Astronomy was entirely unknown to the Ancients, till about the Year 1610, when *Galileus* in *Italy* first discover'd that *Jupiter* was environ'd with four Moons or Satellites; and in *Germany* by *Simon Marius*, by Help of the Telescope, without which,



which, by Reason of *Jupiter's* Splendor, and their small Distance from him, they are not to be discerned. Thus, they being discovered, it put our Moderns upon examining their Motions, and framing a Theory, which is now sufficiently done; and I can now (when *Jupiter* is not too near the Sun) shew them upon Demand to any one that is minded to be satisfied of the Truth hereof. The Circum-saturnials are in Number Five, which by reason of their great Distance from the Sun, and the Smallness of their Bodies, are not to be seen but by the Help of very long Telescopes; the diligent *Cassini* was the first that saw the 1, 2, 3 and 5 Satellites, with a Telescope of 17 Feet, about the End of *October* in the Year 1671. But the 4th of *Saturn's* Moons was first discover'd by Mr. *Hugens*, Anno 1655. These Satellites of *Jupiter*, as well as of *Saturn*, are called *Secondary Planets*, *Moons*, or *Concomitants*; for they constantly keep close to their respective Primaries, and always attend upon them in their Circulations round the Sun; and in the mean time each of them performs his proper Revolution round his proper Primary: The Earth indeed has only the Moon to keep her company, who never forsakes her in her annual Course round the Sun; and while she attends upon us, she performs proper Circulations of her own round the Earth, in the Space of near a Month. The Satellites of *Saturn* have also been seen in *England* by means of that Telescope which was given to the Royal Society by the *Dutch* Astronomer, Mr. *Hugens*, whose Length is 125 Feet, by which nearly a perfect Theory of their Motions are settled; and from those Observations and Theory, I have formed these Tables of their Motions. To these Satellites belong peculiar Phenomena, which are these:

1. That they cannot be seen with the naked Eye.
2. That they cannot always be seen by them that look at them thro' a Telescope.
3. They always appear in a right Line with their Primary, some to the Right, and some to the Left-Hand; at other times, all to the Right, or all to the Left-Hand.
4. That they are continually changing their apparent Distances from their Primaries, seeming at one time to be near, and at another time further removed.
5. That as they are viewed by us from the Earth, they seem to go sometimes to the East, and at other times

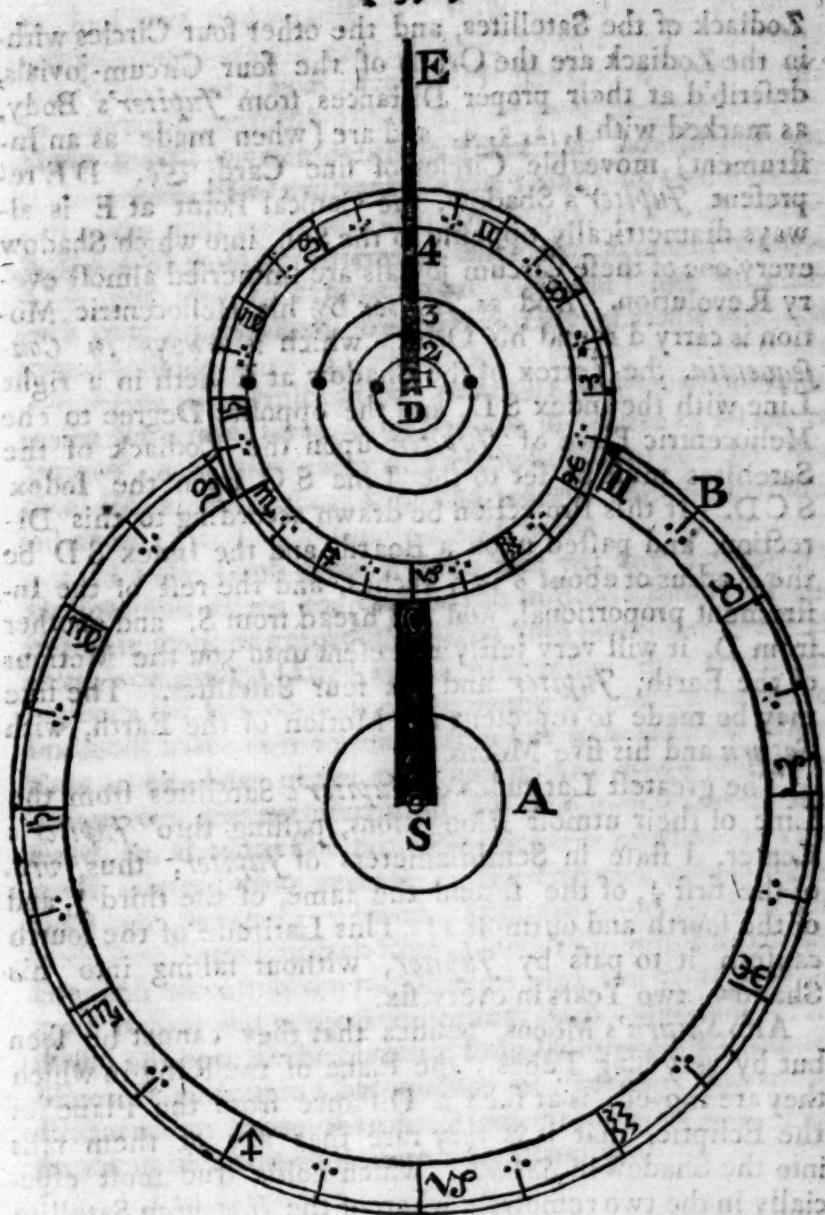
times to move to the West. 6. That when you look at them with two convex Glasses, they always appear on the contrary Side of their Primary to what they really are. 7. That Regard is to be had to the different Situation of the Earth, and the Place of the Observer, from these Phenomena of their Places ; for such a Phenomenon is sooner seen when the Earth is nearer to it, than when it is removed from it. See the Theory of *Jupiter* in my System of the Planets, demonstrated Plate 10. Figure 4. 8. That when  $\eta$  is in the Nodes of the Satellites  $\mathcal{M}$  &  $\mathcal{X}$  21<sup>o</sup>, the Sun is in the Plane of the Ring, from those Places ; therefore the right Ascension and Declination is computed. 9. As far as can be discovered by us at so great a Distance, the Orbit of these Satellites appearing little or nothing eccentric ; and by comparing the Periods of their Motions with the Periods of our Moon round the Earth, and the Periods of *Jupiter* and *Saturn* with the Period of the Earth round the Sun ; the Inequalities in the Motions of these Satellites, may be deriv'd from the Inequalities in the Moon's Motion describ'd above in her Theory. These being their chief Phenomena.

We well know that the Motion of these Satellites are disturbed by the Sun acting upon them, and also by each other's Attraction, and by the Attraction of their Superiours or Primary Planets ; but these Things being more physical than astronomical, I shall not trouble my Reader with them at this Time, but refer them to Sir *Isaac Newton's* Philosophy, and *Gregory's* Elements.

The third Satellite from *Jupiter* is of the first Magnitude, the first of that next to his Body is the second Magnitude, the second Satellite is of the third, and the fourth or outmost is of the fourth Magnitude. By these Directions it will not be difficult for an Observer to distinguish one Satellite from another. And the *Hugenean* or fourth of *Saturn's* Satellites, is the greatest of his Guards.

As the  $\mathcal{D}$  (the Earth's Satellite) is carry'd round the Sun along with the Earth in a Year, so are also the Satellites of *Jupiter* and *Saturn* carry'd round the Sun in the times of their respective Revolutions of their Primaries. And for a Demonstration hereof, I have framed the following Diagram after the Nature of my Lunar Instrument, which will make their Motions very plain and easy ; in which

let



let S represent the Sun; A the Earth's Orb, B *Jupiter's* Orb, divided into the 12 Signs of the Zodiack, the Index C is moveable, and lieth under the Orbs of the Satellites, and terminates at D, on which *Jupiter* at D moves round the Sun, and carries his four Satellites along with him; the outmost Circle from *Jupiter* at D represents the Zodiack marked with the 12 Signs thereof, which I call the Zo-



Zodiack of the Satellites, and the other four Circles within the Zodiack are the Orbits of the four Circum-jovials, describ'd at their proper Distances from *Jupiter's* Body, as marked with 1, 2, 3, 4, and are (when made as an Instrument) moveable Circles of fine Card, &c. DE represent *Jupiter's* Shadow, the Conical Point at E is always diametrically opposite to the Sun, into which Shadow every one of these Circum-jovials are immersed almost every Revolution. And as *Jupiter* by his Heliocentric Motion is carry'd round his Orbit, which is always in *Consequentia*, the Vertex of the Shadow at E lieth in a right Line with the Index SD, and the opposite Degree to the Heliocentric Place of *Jupiter* upon the Zodiack of the Satellites must be set to the Line SC upon the Index SCD. If this Projection be drawn according to this Direction, and pasted upon a Board, and the Index SD be the Radius of about 6 or 7 Inches, and the rest of the Instrument proportional, and a Thread from S, and another from D, it will very justly represent unto you the Motions of the Earth, *Jupiter* and his four Satellites. The like may be made to represent the Motion of the Earth, with *Saturn* and his five Moons.

The greatest Latitudes of *Jupiter's* Satellites from the Line of their utmost Elongations, passing thro' *Jupiter's* Center, I state in Semidiameters of *Jupiter*, thus, viz. of the first  $\frac{1}{2}$ , of the second the same, of the third  $\frac{1}{2}$ , and of the fourth and outmost  $1\frac{1}{2}$ : This Latitude of the fourth causeth it to pass by *Jupiter*, without falling into his Shadow, two Years in every six.

Also *Saturn's* Moons, besides that they cannot be seen but by very long Tubes; the Plane of the Ring in which they are moved, is at such a Distance from the Plane of the Ecliptic, that it is very rare that any of them falls into the Shadow of *Saturn*: which holds true most especially in the two remotest, whereof the *Hugenian* Satellite is one, whose Place I shall shew how to calculate by and by.

P R E.

## P R E C E P T I.

*Shewing how to calculate the Distances of Jupiter's Satellites, and to distinguish one from another.*

**M**Y Design is here only to shew the ingenious Observer how to find at what Distance from *Jupiter* each Satellite appears, that so he may not mistake one from another.

1. From the Tables in my compleat System of Astronomy to the given Time, calculate the Heliocentric Place of *Jupiter*, as is there shew'd, from which subtract the Radical Place 5 *si*.  $13^{\circ} 22' 57''$ , and reserve the Remainder till anon.

2. To the same given Time, that you found *Jupiter's* Heliocentric Place to, collect the middle Motions of the Satellite from its respective Table into one Sum, to which Sum, add always (after the Radix 1684) the Difference between the Heliocentric Place of the Radix, and the Heliocentric Place at the given Time just now reserv'd ; this Sum is the Place of the Satellite at the given Time, to answer our present Purpose. From which Place of the Satellite, subtract the Heliocentric Place of *Jupiter* at the given Time, what remains is the Distance of the Satellite from *Jupiter* ; with this Distance enter the Table of each Satellite's Distance from 4 under the respective Satellite, and there is given its Distance from the Center of *Jupiter* in Semidiameters and decimal Parts. Here note, That if the Distance of the Satellite from *Jupiter* be less than six Signs, it is then in Consequence of *Jupiter* ; but if the Distance be more than six Signs, it is in Antecedence, as the said Table will more fully direct you.

*Example.*

Anno 1728, December 16<sup>d</sup> 9<sup>h</sup> 1' 48", I observed with my 13 $\frac{1}{2}$  Feet Tube, and two convex Glasses, the 2<sup>d</sup>, 3<sup>d</sup>, and 4<sup>th</sup> of *Jupiter's* Satellites (the first being at that time eclipsed) how were they by my Satellite Tables?

G

Ope-

( 42 )

## Operation.

| Equal Time    | Long 4 |    |    |    | Anom. 4 |    |    |    |
|---------------|--------|----|----|----|---------|----|----|----|
|               | f.     | o  | '  | "  | f.      | o  | '  | "  |
| 1728          | 1      | 26 | 56 | 17 | 7       | 16 | 48 | 53 |
| Dec. 16 Biff. |        | 29 | 10 | 48 |         | 29 | 9  | 37 |
| H. 9          |        |    | 1  | 52 |         |    | 1  | 52 |
| 1 48          |        |    |    |    |         |    |    |    |
| M. Mot.       | 2      | 26 | 8  | 57 | 8       | 16 | 00 | 22 |
| Equat. add.   |        | 5  | 25 | 58 |         |    |    |    |
| 4 Helioc.     | 3      | 1  | 34 | 55 |         |    |    |    |
| Radix sub.    | 5      | 13 | 22 | 57 |         |    |    |    |
| 4 à Radix     | 9      | 18 | 11 | 58 |         |    |    |    |

| Equal Time    | Satellite 1. |    |    |    | Satellite 2. |    |    |    | Satellite 3. |    |    |    | Satellite 4. |    |    |    |
|---------------|--------------|----|----|----|--------------|----|----|----|--------------|----|----|----|--------------|----|----|----|
|               | f.           | o  | '  | "  | f.           | o  | '  | "  | f.           | o  | '  | "  | f.           | o  | '  | "  |
| 1728          | 11           | 23 | 9  | 1  | 2            | 8  | 15 | 54 | 6            | 27 | 46 | 57 | 3            | 24 | 19 | 14 |
| Decemb.       | 8            | 17 | 32 | 1  | 11           | 21 | 22 | 34 | 7            | 8  | 19 | 29 | 11           | 26 | 51 | 38 |
| Days 16 Biff. | 7            | 7  | 53 | 54 | 9            | 11 | 57 | 23 | 4            | 13 | 59 | 12 | 5            | 17 | 40 |    |
| Hours 9       | 2            | 16 | 16 | 38 | 1            | 7  | 59 | 3  | 18           | 50 | 16 |    | 8            | 3  | 29 |    |
| Min. 1        |              |    | 8  | 29 |              |    | 4  | 13 |              |    | 2  | 6  |              |    | 54 |    |
| Seconds 48    |              |    | 6  | 47 |              |    | 3  | 23 |              |    | 1  | 40 |              |    | 43 |    |
| Sum —         | 5            | 14 | 36 | 50 | 0            | 19 | 42 | 30 | 7            | 8  | 59 | 40 | 4            | 4  | 39 | 38 |
| 4 à Radix     | 9            | 18 | 11 | 58 | 9            | 18 | 11 | 58 | 9            | 18 | 11 | 58 | 9            | 18 | 11 | 58 |
| Satellite     | 3            | 02 | 48 | 48 | 10           | 7  | 54 | 28 | 4            | 27 | 11 | 38 | 1            | 22 | 51 | 36 |
| 4 Helioc.     | 3            | 1  | 34 | 55 | 3            | 1  | 34 | 55 | 3            | 1  | 34 | 55 | 3            | 1  | 34 | 55 |
| Distance.     | 0            | 1  | 13 | 53 | 7            | 6  | 19 | 33 | 1            | 25 | 36 | 43 | 10           | 21 | 16 | 41 |

Hence, it appears by the Calculation, that the first Satellite was at the time of the Observation in the Shadow, because its Distance from *Jupiter's* Heliocentric Place was less than the Semiduration or Half-Stay in the Shadow  $9^{\circ} 19' 22''$ , and so of the other three.

The 2d and 4th were in Antecedence, and the third Satellite in Consequence of *Jupiter* : But appear'd on the contrary Side of him, for the Reasons above given.



2. The Satellites of *Saturn* may be found, as I have shewed in *Jupiter's*, with this Difference only, that as *Jupiter's* Satellites are immerfed into his Shadow, and *Saturn's* seldom are, that you work with *Saturn's* Geocentric Place, and you will have the Distance of his Moons from him, and also from each other; however, to satisfy the Curious and more Inquisitive, I shall here shew the Method of *Hugens*, improv'd by Dr. *Halley*, in the *Philos. Transact.*

1. By the 8th Precept of my *Compleat System of Astronomy*, find the true Geocentric Place of *Saturn* to the time propos'd; from which subtract always the Place of the Apocronion (as they call it) 11 f.  $20^{\circ} 23' 48''$ , the Remainder is the Distance of *Saturn* from the Equinox of the Ring. To which Place or Remainder, find the right Ascension and Declination by the 2d and 3d Problems of my Book before cited; only here observe, that you make Use of  $31^{\circ}$  for the Obliquity or Inclination of this Satellite, instead of  $23^{\circ} 29'$ .

2. To the Right Ascension thus found, add the Place of the Apocronion 11 f.  $20^{\circ} 23' 48''$ , the Sum shall be the Longitude of the Satellites Apogeeon; then say, As Radius, to the Sine of the Declination (found to the Obliquity  $31^{\circ}$ ) So is 8, To the grearest Latitude in Apogeeon or Perigeeon in the Parts of the Semidiameter of the Ring. Or so is 18, to the Parts of the Semidiameter of *Saturn's* Globe.

3. To the given Time collect the middle Motion of the Satellite, and from it subtract the Place of the Apocronion 11 20 23 48, the Remainder will be the mean Anomaly; with which, in the Table of the Moon's Equation in my *Compleat System of Astronomy*, take out the Equation answering thereto, and the Half thereof added or subtracted to or from the mean Motion, according to the Title of the said Lunar Table, gives the true Motion of the Satellite, from which subtract the Apogeeon as found in the last Precept, and if the Remainder be more than six Signs, the Satellite is Occidental; if less, Oriental: Then as Radius, to the Sine of the Remainder, so is 8, to the Semidiameter of the Ring; or 18 to the Semidiameter of  $\frac{1}{2}$  Globe, that the Satellite is to the Eastward or Westward of the Center of *Saturn* accordingly.

4. As Radius, to Co-Sine of the said Remainder, so is the greatest Latitude from the Line of the Ansa, found by Precept 2. to the Latitude sought. Example, *Anno 1657, May 19, New Stile, about 10 at Night, Mr. Hugen* observed the 4 Satellites very near to  $\bar{h}$  on the Western Side, and very little above the Line of the Ansa.

## Operation.

*Anno 1657, May 9<sup>d</sup> 9<sup>h</sup> 40' P. M. at London.*

|                                              | f.                 | °  | '  | "                     |
|----------------------------------------------|--------------------|----|----|-----------------------|
| Saturn's Geocentric Place                    | 5                  | 28 | 53 | 8                     |
| Apocronion sub.                              | 11                 | 20 | 23 | 48                    |
| $\bar{h}$ ab Equinox of the Ring             | 6                  | 8  | 29 | 20                    |
| Right Ascension answering                    | 6                  | 7  | 17 | 9                     |
| Place Apogeon                                | 5                  | 27 | 40 | 48                    |
| Declinat. South                              |                    | 4  | 21 | 0                     |
| Greatest Latitude in Apog. $\frac{0.5}{100}$ |                    |    |    |                       |
| Radix                                        | 1681               | 1  | 0  | 48 56                 |
| Mot. for Years sub.                          | 24                 | 8  | 29 | 35 15                 |
| Remains the Radix                            | 1657               | 4  | 1  | 13 41                 |
| May                                          |                    | 6  | 9  | 14 6                  |
| Days 9                                       | 6                  | 23 | 11 | 33                    |
| Hours 9                                      |                    | 8  | 27 | 59                    |
| Min. 40                                      |                    |    | 37 | 38                    |
| M. Motion                                    | 5                  | 12 | 44 | 57                    |
| Apocr. sub.                                  | 11                 | 20 | 23 | 48                    |
| Anom.                                        | 5                  | 22 | 21 | 9                     |
| Equat. sub.                                  |                    | 18 | 23 |                       |
| Long. Satell.                                | 5                  | 12 | 26 | 34                    |
| Apog. sub.                                   | 5                  | 27 | 40 | 48                    |
| Rem.                                         | 11                 | 14 | 45 | 46 Occident.          |
| Comple.                                      | 0                  | 15 | 14 | 14 Before the Apogee. |
| True Latitude North $\frac{2.5}{100}$        | Parts of the Ring. |    |    |                       |

Here

Here follows a Catalogue of the Observations from which I constructed these Tables of the Satellites of Jupiter and Saturn.

*Anno 1657, May 19, N. S. about 10 at Night, Monf. Hugenſ,* with his long Glaſſes, obſerved the 4 Satellites of *Saturn* a little above the Line of the Anſæ, and very near to *Saturn* on the Western Side, that Planet was then in  $\text{R } 28^{\circ} 53' 8''$ .

*Anno 1658, Mar. 11, N. S. at 10 P. M. Monf. Hugenſ* obſerved the ſame Satellite a little to the Eaſt of *Saturn*, and on the South ſide of him.

*Anno 1659, March 14, N. S. 12<sup>h</sup> P. M. at the Hague,* Monf. *Hugenſ* obſerved the 4th Satellite about one Diameter of the Ring under *Saturn*: but it was gone ſo far to the Weſtward, that he concluded, that about four Hours before, or 7<sup>h</sup> 40' at *London*, it had been in Perigæo.

*Anno 1659, March 22<sup>d</sup> 10<sup>h</sup> 45' P. M.* this Satellite was a whole Diameter above the Line of the Anſæ, and the Perpendicular thereon fell nearly upon the Extremity of the Eaſtern Anſæ.

*Anno 1682, November 13<sup>d</sup> 13<sup>h</sup> P. M. Dr. Halley* obſerved *Saturn's* 4th Satellite in Perigæo on the North Side of him; and a Perpendicular let fall from it on the tranſverſe Diameter of the Ring, fell upon the Middle of the dark Spot of the following Anſæ.

Again, *November 21<sup>d</sup> 16<sup>h</sup> 15' P. M.* this Satellite was on the South Side, the Perpendicular on the Line of the Anſæ fell on the Middle of the dark Spot of the Western Anſæ; and the ſame Night at 19<sup>h</sup>, the Perpendicular fell preciſely on the Center of *Saturn*; it was now in Apogæo.

*Anno 1683, Jan. 24, at 8 at Night,* he obſerved this Satellite in Apogæo, the Perpendicular on the Line of the Anſæ fell exactly on the Western Limb of *h*, and at 9<sup>h</sup> 30' the ſaid Perpendicular fell within the Globe more than half Way to the Center, and diſtant from the Line of the Anſæ towards the South, about one Diameter of the Ring.

*Anno 1683, Feb. 9<sup>d</sup> 8<sup>h</sup> 10' P. M.* this 4th Satellite was in Apogæo, and about one Diameter of *Saturn's* Ring to the South.

*Anno*



Anno 1714, April 4<sup>d</sup> 21<sup>h</sup> 30' N. S. Monf. *Cassini*, at the Royal Observatory in *France*, observed the innermost of  $\text{h}$  Satellites in its inferior Conjunction with *Saturn*, he was then in  $\text{MR } 5^{\circ} 23' 32''$  by my Tables, and the same time the second Satellite was in its superior Conjunction with *Saturn*.

Anno 1714, M. *Cassini* observed the third Satellite of *Saturn*, April 4<sup>d</sup> 10<sup>h</sup> N. S. to have newly pass'd its inferior Conjunction with *Saturn*, and a Perpendicular from it fell on the Extremity of the Western Ansa, so that at about 5<sup>h</sup> P. M. it was with the Center of *Saturn* then in  $\text{MR } 5^{\circ} 27' \text{ R.}$  and consequently the Satellite was in  $\text{X } 5^{\circ} 27'.$

Anno 1715, March 25<sup>d</sup> 11<sup>h</sup> P. M. M. *Cassini* observed the Hugenian or 4th Satellite in Apogæo, and did immerge behind the Body of *Saturn*, he was then in  $\text{MR } 20^{\circ} 3' 33'' \text{ R.}$

Anno 1714, May 6<sup>d</sup>, 12<sup>h</sup> P. M. *Cassini* observed the 5th or outmost Satellite in its superior Conjunction with  $\text{h}$  he being then Retrograde in  $\text{MR } 4^{\circ} 32' 45''.$

Anno 1718, April 21<sup>d</sup> 10<sup>h</sup> 4', Mr. *Pound* at *Wansted*, by Help of the Royal Society's 125 Feet Glass, observed the 3d and 4th Satellites of  $\text{h}$  in Apogæo, a little past their Conjunction with *Saturn*. The first was Northward of the Line of the Ansa; and therefore in the Apogæon Semicircle distant from the said Line  $\frac{1}{2}$  of *Saturn*'s Semidiameter, and about a Semidiameter of the Ring from the Western Ansa.

The 2d was a very little Southward of the Line of the Ansa (and therefore in the Perigæon Semicircle) above a Semidiameter of the Ring from the Western Ansa. The 3d, 1st and 2d, were in a straight Line.

And, April 22<sup>d</sup> 11<sup>h</sup> 5' P. M. the four innermost Satellites were all Eastward of  $\text{h}$ , the 2d and 4th in the Apogæon, and the 1st and 3d in the Perigæon Semicircle: The 5th or outmost Satellite was at this time near its greatest Elongation Eastward.

The Tables of the Satellites of *Jupiter* I have deduced from the Observations of Mr. *Flamsted*, confirmed with abundance of my own.

A.

## A Table of the Mean Motion of the Moon

| Years | Long. D. |    |    |    | Apog. D. |    |    |    | Node D. |    |    |    |
|-------|----------|----|----|----|----------|----|----|----|---------|----|----|----|
|       | f.       | o  | '  | "  | f.       | o  | '  | "  | f.      | o  | '  | "  |
| 1681  | 6        | 1  | 45 | 55 | 8        | 4  | 29 | 45 | 5       | 24 | 13 | 35 |
| 1682  | 10       | 11 | 8  | 58 | 9        | 15 | 9  | 35 | 5       | 4  | 53 | 52 |
| 1683  | 2        | 20 | 32 | 1  | 10       | 25 | 49 | 26 | 4       | 15 | 34 | 9  |
| 1684  | 6        | 29 | 55 | 4  | 0        | 6  | 29 | 18 | 3       | 26 | 14 | 26 |
| 1685  | 11       | 22 | 28 | 42 | 1        | 17 | 15 | 49 | 3       | 6  | 51 | 32 |
| 1686  | 4        | 1  | 51 | 45 | 2        | 27 | 55 | 39 | 2       | 17 | 31 | 49 |
| 1687  | 8        | 11 | 14 | 48 | 4        | 8  | 35 | 29 | 1       | 28 | 12 | 6  |
| 1688  | 0        | 20 | 37 | 51 | 5        | 19 | 15 | 20 | 1       | 8  | 52 | 23 |
| 1689  | 5        | 13 | 11 | 30 | 7        | 0  | 1  | 51 | 0       | 19 | 29 | 29 |
| 1690  | 9        | 22 | 34 | 34 | 8        | 10 | 41 | 42 | 0       | 0  | 9  | 46 |
| 1691  | 2        | 1  | 57 | 38 | 9        | 21 | 21 | 32 | 11      | 10 | 50 | 3  |
| 1692  | 6        | 11 | 20 | 42 | 11       | 2  | 1  | 23 | 10      | 21 | 30 | 20 |
| 1693  | 11       | 3  | 54 | 21 | 0        | 12 | 47 | 54 | 10      | 2  | 7  | 26 |
| 1694  | 3        | 13 | 17 | 24 | 1        | 23 | 27 | 45 | 9       | 12 | 47 | 43 |
| 1695  | 7        | 22 | 40 | 27 | 3        | 4  | 7  | 35 | 8       | 23 | 28 | 0  |
| 1696  | 0        | 2  | 3  | 31 | 4        | 14 | 47 | 26 | 8       | 4  | 8  | 17 |
| 1697  | 4        | 24 | 37 | 34 | 5        | 25 | 33 | 57 | 7       | 14 | 45 | 23 |
| 1698  | 9        | 4  | 0  | 12 | 7        | 6  | 13 | 48 | 6       | 25 | 25 | 40 |
| 1699  | 1        | 13 | 23 | 17 | 8        | 16 | 53 | 38 | 6       | 6  | 5  | 57 |
| 1700  | 5        | 22 | 46 | 21 | 9        | 27 | 33 | 28 | 5       | 16 | 46 | 14 |
| 1701  | 10       | 15 | 20 | 0  | 11       | 8  | 20 | 0  | 4       | 27 | 23 | 20 |
| 1702  | 2        | 24 | 43 | 3  | 0        | 18 | 59 | 50 | 4       | 8  | 3  | 37 |
| 1703  | 7        | 4  | 6  | 6  | 1        | 29 | 39 | 40 | 3       | 18 | 43 | 54 |
| 1704  | 11       | 13 | 29 | 9  | 3        | 10 | 19 | 31 | 2       | 29 | 24 | 11 |
| 1705  | 4        | 6  | 2  | 47 | 4        | 21 | 6  | 2  | 2       | 10 | 1  | 17 |
| 1706  | 8        | 15 | 25 | 50 | 6        | 1  | 45 | 52 | 1       | 20 | 41 | 34 |
| 1707  | 0        | 24 | 48 | 53 | 7        | 12 | 25 | 42 | 1       | 1  | 21 | 51 |

## A Table of the Mean Motion of the Moon

| Years | Long. D. |    |    |    | Apog. D. |    |    |    | Node D. |    |    |    |
|-------|----------|----|----|----|----------|----|----|----|---------|----|----|----|
|       | f.       | o  | i  | "  | f.       | o  | i  | "  | f.      | o  | i  | "  |
| 1708  | 5        | 4  | 11 | 56 | 8        | 23 | 5  | 34 | 0       | 12 | 2  | 8  |
| 1709  | 9        | 26 | 45 | 34 | 10       | 3  | 52 | 5  | 11      | 22 | 39 | 14 |
| 1710  | 2        | 6  | 8  | 38 | 11       | 14 | 31 | 55 | 11      | 3  | 19 | 31 |
| 1711  | 6        | 15 | 31 | 40 | 0        | 25 | 11 | 45 | 10      | 13 | 59 | 48 |
| 1712  | 10       | 24 | 54 | 45 | 2        | 5  | 51 | 36 | 9       | 24 | 40 | 5  |
| 1713  | 3        | 17 | 28 | 24 | 3        | 16 | 38 | 8  | 9       | 5  | 17 | 11 |
| 1714  | 7        | 26 | 51 | 27 | 4        | 27 | 17 | 58 | 8       | 15 | 57 | 28 |
| 1715  | 0        | 6  | 14 | 31 | 6        | 7  | 57 | 49 | 7       | 26 | 37 | 45 |
| 1716  | 4        | 15 | 37 | 36 | 7        | 18 | 37 | 40 | 7       | 7  | 18 | 2  |
| 1717  | 9        | 8  | 11 | 15 | 8        | 29 | 24 | 12 | 6       | 27 | 55 | 8  |
| 1718  | 1        | 17 | 34 | 19 | 10       | 10 | 4  | 2  | 5       | 28 | 35 | 25 |
| 1719  | 5        | 26 | 57 | 23 | 11       | 20 | 43 | 52 | 5       | 9  | 15 | 42 |
| 1720  | 10       | 6  | 20 | 27 | 1        | 1  | 23 | 43 | 4       | 19 | 55 | 59 |
| 1721  | 2        | 28 | 54 | 5  | 2        | 12 | 10 | 15 | 4       | 0  | 33 | 5  |
| 1722  | 7        | 8  | 17 | 8  | 3        | 22 | 50 | 5  | 3       | 11 | 13 | 22 |
| 1723  | 11       | 17 | 40 | 11 | 5        | 3  | 29 | 56 | 2       | 21 | 53 | 39 |
| 1724  | 3        | 27 | 3  | 14 | 6        | 14 | 9  | 46 | 2       | 2  | 33 | 56 |
| 1725  | 8        | 19 | 36 | 52 | 7        | 24 | 56 | 18 | 1       | 13 | 11 | 2  |
| 1726  | 0        | 28 | 59 | 55 | 9        | 5  | 36 | 8  | 0       | 23 | 51 | 19 |
| 1727  | 5        | 8  | 22 | 58 | 10       | 16 | 15 | 59 | 0       | 4  | 31 | 36 |
| 1728  | 9        | 17 | 46 | 1  | 11       | 26 | 55 | 49 | 11      | 15 | 11 | 53 |
| 1729  | 2        | 10 | 19 | 39 | 1        | 7  | 42 | 20 | 10      | 25 | 48 | 59 |
| 1730  | 6        | 19 | 42 | 42 | 2        | 18 | 21 | 10 | 10      | 6  | 29 | 16 |
| 1731  | 10       | 29 | 5  | 46 | 3        | 29 | 2  | 1  | 9       | 17 | 9  | 33 |
| 1732  | 3        | 8  | 28 | 50 | 5        | 9  | 41 | 51 | 8       | 27 | 49 | 50 |
| 1733  | 8        | 1  | 2  | 29 | 6        | 20 | 28 | 23 | 8       | 8  | 26 | 56 |
| 1734  | 0        | 10 | 25 | 33 | 8        | 1  | 8  | 13 | 3       | 19 | 7  | 13 |



moon's in Years Current. 1730 to 1761

| Years | Long. D. |    |    |    | Apog. D. |    |    |    | Node D. |    |    |    |
|-------|----------|----|----|----|----------|----|----|----|---------|----|----|----|
|       | f.       | o  | '  | "  | f.       | o  | '  | "  | f.      | o  | '  | "  |
| 1735  | 4        | 19 | 48 | 37 | 9        | 11 | 48 | 4  | 6       | 29 | 47 | 30 |
| 1736  | 8        | 29 | 11 | 41 | 10       | 22 | 27 | 54 | 6       | 10 | 27 | 47 |
| 1737  | 1        | 21 | 45 | 20 | 0        | 3  | 14 | 26 | 5       | 21 | 4  | 53 |
| 1738  | 6        | 1  | 8  | 24 | 1        | 13 | 54 | 16 | 5       | 1  | 45 | 10 |
| 1739  | 10       | 10 | 21 | 28 | 2        | 24 | 34 | 7  | 4       | 12 | 25 | 27 |
| 1740  | 2        | 19 | 54 | 32 | 4        | 5  | 13 | 58 | 3       | 23 | 5  | 44 |
| 1741  | 7        | 12 | 28 | 10 | 5        | 16 | 0  | 30 | 3       | 3  | 42 | 50 |
| 1742  | 11       | 21 | 51 | 13 | 6        | 26 | 40 | 20 | 2       | 14 | 23 | 7  |
| 1743  | 4        | 1  | 14 | 17 | 8        | 7  | 20 | 11 | 1       | 25 | 3  | 24 |
| 1744  | 8        | 10 | 37 | 19 | 9        | 18 | 0  | 0  | 1       | 5  | 43 | 41 |
| 1745  | 1        | 3  | 10 | 58 | 10       | 28 | 46 | 32 | 0       | 16 | 20 | 47 |
| 1746  | 5        | 12 | 34 | 1  | 0        | 9  | 26 | 12 | 11      | 27 | 1  | 4  |
| 1747  | 9        | 21 | 57 | 5  | 1        | 20 | 6  | 13 | 11      | 7  | 41 | 21 |
| 1748  | 2        | 1  | 20 | 8  | 3        | 0  | 46 | 3  | 10      | 18 | 21 | 38 |
| 1749  | 6        | 23 | 53 | 47 | 4        | 11 | 32 | 34 | 9       | 28 | 58 | 44 |
| 1750  | 11       | 3  | 16 | 49 | 5        | 22 | 12 | 24 | 9       | 9  | 39 | 1  |
| 1751  | 3        | 12 | 39 | 54 | 7        | 2  | 52 | 15 | 8       | 20 | 19 | 18 |
| 1752  | 7        | 22 | 2  | 57 | 8        | 13 | 32 | 5  | 8       | 0  | 59 | 35 |
| 1753  | 0        | 14 | 36 | 36 | 9        | 24 | 18 | 38 | 7       | 11 | 36 | 41 |
| 1754  | 4        | 23 | 59 | 39 | 11       | 4  | 58 | 28 | 6       | 22 | 16 | 58 |
| 1755  | 9        | 3  | 22 | 42 | 0        | 15 | 38 | 19 | 6       | 2  | 57 | 15 |
| 1756  | 1        | 12 | 45 | 46 | 1        | 26 | 18 | 9  | 5       | 13 | 37 | 32 |
| 1757  | 6        | 5  | 19 | 26 | 3        | 7  | 4  | 41 | 4       | 24 | 14 | 38 |
| 1758  | 10       | 14 | 42 | 30 | 4        | 17 | 44 | 32 | 4       | 4  | 54 | 55 |
| 1759  | 2        | 24 | 5  | 34 | 5        | 28 | 24 | 22 | 3       | 15 | 35 | 12 |
| 1760  | 7        | 3  | 28 | 37 | 7        | 9  | 4  | 13 | 2       | 26 | 15 | 29 |
| 1761  | 11       | 26 | 2  | 15 | 8        | 19 | 50 | 45 | 2       | 6  | 52 | 35 |

A Table of the Mean Motion of the Moon

| Years | Long. D. |    |    |    | Apog. D. |    |    |    | Node D. |    |    |    |
|-------|----------|----|----|----|----------|----|----|----|---------|----|----|----|
|       | f.       | o  | 1  | "  | f        | o  | 1  | "  | f.      | o  | 1  | "  |
| 1762  | 4        | 5  | 25 | 18 | 10       | 6  | 30 | 35 | 1       | 17 | 32 | 52 |
| 1763  | 8        | 14 | 48 | 22 | 11       | 11 | 10 | 26 | 0       | 28 | 13 | 9  |
| 1764  | 0        | 24 | 11 | 25 | 0        | 21 | 50 | 16 | 0       | 8  | 53 | 16 |
| 1765  | 5        | 16 | 45 | 4  | 2        | 2  | 36 | 48 | 11      | 19 | 30 | 32 |
| 1766  | 9        | 26 | 8  | 8  | 3        | 13 | 16 | 38 | 11      | 0  | 10 | 49 |
| 1767  | 2        | 5  | 31 | 11 | 4        | 23 | 56 | 18 | 10      | 10 | 51 | 6  |
| 1768  | 6        | 14 | 54 | 15 | 6        | 4  | 36 | 19 | 9       | 21 | 31 | 23 |
| 1769  | 11       | 7  | 27 | 54 | 7        | 15 | 22 | 52 | 9       | 2  | 8  | 29 |
| 1770  | 3        | 16 | 50 | 57 | 8        | 26 | 2  | 42 | 8       | 12 | 48 | 46 |
| 1771  | 7        | 26 | 14 | 1  | 10       | 6  | 43 | 32 | 7       | 23 | 29 | 3  |
| 1772  | 0        | 5  | 37 | 4  | 11       | 17 | 22 | 23 | 7       | 4  | 9  | 20 |
| 1773  | 4        | 28 | 10 | 43 | 0        | 28 | 8  | 53 | 6       | 14 | 46 | 26 |
| 1774  | 9        | 7  | 33 | 46 | 2        | 8  | 48 | 43 | 5       | 25 | 26 | 43 |
| 1775  | 1        | 16 | 56 | 50 | 3        | 19 | 28 | 38 | 5       | 6  | 7  | 0  |
| 1776  | 5        | 26 | 19 | 53 | 5        | 0  | 8  | 26 | 4       | 16 | 47 | 17 |
| 1777  | 10       | 18 | 53 | 32 | 6        | 10 | 54 | 50 | 3       | 27 | 24 | 23 |
| 1778  | 2        | 28 | 16 | 35 | 7        | 21 | 34 | 47 | 3       | 8  | 4  | 40 |
| 1779  | 7        | 7  | 39 | 39 | 9        | 2  | 14 | 37 | 2       | 18 | 44 | 57 |
| 1780  | 11       | 17 | 2  | 42 | 10       | 12 | 54 | 28 | 1       | 29 | 25 | 14 |
| 1781  | 4        | 9  | 36 | 20 | 11       | 23 | 41 | 0  | 1       | 10 | 2  | 20 |
| 1782  | 8        | 18 | 59 | 23 | 1        | 4  | 20 | 51 | 0       | 20 | 42 | 37 |
| 1783  | 0        | 28 | 22 | 27 | 2        | 15 | 0  | 41 | 0       | 1  | 22 | 54 |
| 1784  | 5        | 7  | 45 | 30 | 3        | 25 | 40 | 32 | 11      | 12 | 3  | 11 |
| 1785  | 10       | 0  | 19 | 9  | 5        | 6  | 27 | 2  | 10      | 22 | 40 | 17 |
| 1786  | 2        | 9  | 42 | 12 | 6        | 17 | 6  | 53 | 10      | 3  | 20 | 34 |
| 1787  | 6        | 19 | 5  | 16 | 7        | 27 | 46 | 44 | 9       | 14 | 0  | 51 |
| 1788  | 10       | 28 | 28 | 19 | 9        | 8  | 26 | 35 | 8       | 24 | 41 | 8  |

in Years Current.

| Years | Long. D. |    |    |    | Apog. D. |    |    |    | Node D. |    |    |    |
|-------|----------|----|----|----|----------|----|----|----|---------|----|----|----|
|       | f.       | °  | '  | "  | f.       | °  | '  | "  | f.      | °  | '  | "  |
| 1789  | 3        | 21 | 1  | 57 | 10       | 19 | 13 | 7  | 8       | 5  | 18 | 14 |
| 1790  | 8        | 0  | 25 | 1  | 11       | 29 | 52 | 57 | 7       | 15 | 58 | 31 |
| 1791  | 0        | 9  | 48 | 4  | 1        | 10 | 32 | 48 | 6       | 26 | 38 | 48 |
| 1792  | 4        | 19 | 11 | 8  | 2        | 21 | 12 | 38 | 6       | 7  | 19 | 5  |
| 1793  | 9        | 11 | 44 | 47 | 4        | 1  | 59 | 10 | 5       | 17 | 56 | 11 |
| 1794  | 1        | 21 | 7  | 50 | 5        | 12 | 39 | 0  | 4       | 28 | 36 | 28 |
| 1795  | 6        | 0  | 30 | 54 | 6        | 23 | 18 | 50 | 4       | 9  | 16 | 45 |
| 1796  | 10       | 9  | 53 | 57 | 8        | 3  | 58 | 41 | 3       | 19 | 57 | 2  |
| 1797  | 3        | 2  | 27 | 36 | 9        | 14 | 45 | 12 | 3       | 0  | 34 | 8  |
| 1798  | 7        | 11 | 50 | 59 | 10       | 25 | 25 | 2  | 2       | 11 | 14 | 25 |
| 1799  | 11       | 21 | 13 | 43 | 0        | 6  | 4  | 53 | 1       | 21 | 54 | 42 |
| 1800  | 4        | 0  | 36 | 46 | 1        | 16 | 44 | 43 | 1       | 2  | 34 | 59 |
| 1801  | 8        | 23 | 10 | 25 | 2        | 27 | 31 | 15 | 0       | 13 | 12 | 5  |
| 1802  | 1        | 2  | 33 | 28 | 4        | 8  | 11 | 5  | 11      | 23 | 52 | 22 |
| 1803  | 5        | 11 | 56 | 32 | 5        | 18 | 50 | 56 | 11      | 4  | 32 | 39 |
| 1804  | 9        | 21 | 19 | 35 | 6        | 29 | 30 | 46 | 10      | 15 | 12 | 56 |
| 1805  | 2        | 13 | 53 | 14 | 8        | 10 | 17 | 18 | 9       | 25 | 50 | 2  |
| 1806  | 6        | 23 | 16 | 17 | 9        | 20 | 57 | 8  | 9       | 6  | 30 | 19 |
| 1807  | 11       | 2  | 39 | 21 | 11       | 1  | 36 | 59 | 8       | 17 | 10 | 36 |
| 1808  | 3        | 12 | 2  | 24 | 0        | 12 | 16 | 49 | 7       | 27 | 50 | 53 |
| 1809  | 8        | 4  | 36 | 3  | 1        | 23 | 3  | 20 | 7       | 8  | 27 | 59 |
| 1810  | 0        | 13 | 59 | 6  | 3        | 3  | 43 | 11 | 6       | 19 | 8  | 16 |
| 1811  | 4        | 23 | 22 | 10 | 4        | 14 | 23 | 2  | 5       | 29 | 48 | 33 |
| 1812  | 9        | 2  | 45 | 13 | 5        | 25 | 2  | 52 | 5       | 10 | 28 | 50 |
| 1813  | 1        | 25 | 18 | 51 | 7        | 5  | 49 | 24 | 4       | 21 | 5  | 56 |
| 1814  | 6        | 4  | 41 | 55 | 8        | 16 | 29 | 13 | 4       | 1  | 46 | 13 |
| 1815  | 10       | 14 | 4  | 58 | 9        | 27 | 9  | 4  | 3       | 12 | 26 | 30 |



A Table of the Mean Motion of the Moon, &amp;c.

| Years | Long. D. |    |    |    | Apog. D. |    |    |    | Node D. |    |    |    |
|-------|----------|----|----|----|----------|----|----|----|---------|----|----|----|
|       | f.       | °  | '  | "  | f.       | °  | '  | "  | f.      | °  | '  | "  |
| 1816  | 2        | 23 | 28 | 2  | 11       | 7  | 48 | 54 | 2       | 23 | 6  | 47 |
| 1817  | 7        | 16 | 1  | 41 | 0        | 18 | 35 | 26 | 2       | 3  | 43 | 53 |
| 1818  | 11       | 25 | 24 | 44 | 1        | 29 | 15 | 16 | 1       | 14 | 24 | 10 |
| 1819  | 4        | 4  | 47 | 48 | 3        | 9  | 55 | 6  | 0       | 25 | 4  | 27 |
| 1820  | 8        | 27 | 10 | 51 | 4        | 20 | 34 | 57 | 0       | 5  | 44 | 43 |
| 1821  | 1        | 6  | 44 | 30 | 6        | 1  | 21 | 30 | 11      | 16 | 21 | 50 |
| 1822  | 5        | 16 | 7  | 33 | 7        | 12 | 1  | 20 | 10      | 27 | 2  | 7  |
| 1823  | 9        | 25 | 30 | 37 | 8        | 22 | 41 | 10 | 10      | 7  | 42 | 24 |
| 1824  | 2        | 4  | 53 | 41 | 10       | 2  | 21 | 1  | 9       | 18 | 22 | 41 |
| 1825  | 6        | 27 | 27 | 19 | 11       | 14 | 7  | 32 | 8       | 28 | 59 | 47 |
| 1826  | 11       | 6  | 50 | 23 | 0        | 24 | 47 | 22 | 8       | 9  | 40 | 4  |
| 1827  | 3        | 16 | 13 | 26 | 2        | 5  | 27 | 12 | 7       | 20 | 20 | 21 |
| 1828  | 7        | 25 | 36 | 30 | 3        | 16 | 7  | 2  | 7       | 1  | 0  | 38 |
| 1829  | 0        | 18 | 10 | 9  | 4        | 26 | 53 | 34 | 6       | 11 | 37 | 44 |
| 1830  | 4        | 27 | 33 | 12 | 6        | 7  | 33 | 24 | 5       | 22 | 18 | 1  |
| 1831  | 9        | 6  | 56 | 15 | 7        | 18 | 13 | 15 | 5       | 2  | 58 | 18 |
| 1832  | 1        | 16 | 19 | 18 | 8        | 28 | 53 | 5  | 4       | 13 | 38 | 35 |
| 1833  | 6        | 8  | 52 | 57 | 10       | 9  | 39 | 37 | 3       | 24 | 15 | 41 |
| 1834  | 10       | 18 | 16 | 0  | 11       | 20 | 19 | 27 | 3       | 4  | 55 | 58 |
| 1835  | 2        | 27 | 39 | 4  | 1        | 0  | 59 | 18 | 2       | 15 | 36 | 15 |
| 1836  | 7        | 7  | 2  | 7  | 2        | 11 | 39 | 9  | 1       | 26 | 16 | 32 |
| 1837  | 11       | 29 | 35 | 46 | 3        | 22 | 25 | 41 | 1       | 6  | 53 | 38 |
| 1838  | 4        | 8  | 54 | 49 | 5        | 3  | 5  | 31 | 0       | 17 | 33 | 55 |
| 1839  | 8        | 18 | 21 | 53 | 6        | 13 | 45 | 21 | 11      | 28 | 14 | 12 |
| 1840  | 0        | 27 | 44 | 56 | 7        | 24 | 25 | 12 | 11      | 8  | 54 | 29 |
| 1841  | 5        | 20 | 18 | 34 | 9        | 5  | 11 | 45 | 10      | 19 | 31 | 36 |
| 1842  | 9        | 29 | 41 | 38 | 10       | 15 | 51 | 35 | 10      | 0  | 11 | 53 |

## The Mean Motion of the Moon.

## JANUARY

| Days | Long. D. M. S. | Apog. D. | Node D. |
|------|----------------|----------|---------|
| 1    | 40 13 10 35    | 0 16 41  | 0 3 11  |
| 2    | 40 26 21 40    | 0 13 22  | 0 6 21  |
| 3    | 41 9 31 45     | 0 20 33  | 0 9 32  |
| 4    | 41 22 42 20    | 0 26 44  | 0 12 43 |
| 5    | 42 1 5 55      | 0 33 25  | 0 15 53 |
| 6    | 42 19 13 30    | 0 40 16  | 0 19 4  |
| 7    | 43 2 14 15     | 0 46 48  | 0 22 14 |
| 8    | 43 15 24 40    | 0 53 29  | 0 25 25 |
| 9    | 43 28 35 15    | 1 0 10   | 0 28 36 |
| 10   | 44 11 45 50    | 1 6 51   | 0 31 46 |
| 11   | 44 24 56 25    | 1 13 32  | 0 34 57 |
| 12   | 45 8 7 40      | 1 20 13  | 0 38 8  |
| 13   | 45 21 17 35    | 1 26 54  | 0 41 18 |
| 14   | 46 3 4 28 10   | 1 33 35  | 0 44 29 |
| 15   | 46 17 38 45    | 1 40 16  | 0 47 40 |
| 16   | 47 29 49 20    | 1 46 57  | 0 50 50 |
| 17   | 47 13 59 55    | 1 53 38  | 0 54 1  |
| 18   | 47 27 10 30    | 2 0 19   | 0 57 11 |
| 19   | 48 10 21 5     | 2 7 0    | 1 0 22  |
| 20   | 48 23 31 40    | 2 13 41  | 1 3 33  |
| 21   | 49 6 42 15     | 2 20 23  | 1 6 43  |
| 22   | 49 19 52 50    | 2 27 4   | 1 9 54  |
| 23   | 50 3 3 25      | 2 33 45  | 1 15 5  |
| 24   | 50 16 14 0     | 2 40 26  | 1 16 15 |
| 25   | 50 29 24 35    | 2 47 7   | 1 19 26 |
| 26   | 51 12 35 10    | 2 53 48  | 1 22 37 |
| 27   | 51 25 45 45    | 3 0 29   | 1 25 47 |
| 28   | 0 8 56 20      | 3 7 10   | 1 28 58 |
| 29   | 0 22 6 55      | 3 13 51  | 1 32 9  |
| 30   | 1 5 17 31      | 3 20 32  | 1 35 19 |
| 31   | 1 18 28 6      | 3 27 13  | 1 38 30 |

## The Mean Motion of the Moon

## FEBRUARY.

| Days | Long. D. |    |       | Agog. D. |    |    | Node D. |    |    |
|------|----------|----|-------|----------|----|----|---------|----|----|
|      | °        | '  | "     | °        | '  | "  | °       | '  | "  |
| 1    | 2        | 1  | 38 41 | 3        | 33 | 54 | 1       | 41 | 40 |
| 2    | 2        | 14 | 49 16 | 3        | 40 | 35 | 1       | 44 | 50 |
| 3    | 2        | 27 | 59 51 | 3        | 47 | 16 | 1       | 48 | 1  |
| 4    | 3        | 11 | 10 26 | 3        | 53 | 57 | 1       | 51 | 12 |
| 5    | 3        | 24 | 21 1  | 4        | 0  | 38 | 1       | 54 | 23 |
| 6    | 4        | 7  | 31 36 | 4        | 7  | 19 | 1       | 57 | 33 |
| 7    | 4        | 20 | 42 11 | 4        | 14 | 0  | 2       | 0  | 44 |
| 8    | 5        | 3  | 52 46 | 4        | 20 | 41 | 2       | 3  | 54 |
| 9    | 5        | 17 | 3 21  | 4        | 27 | 22 | 2       | 7  | 6  |
| 10   | 6        | 0  | 13 56 | 4        | 34 | 4  | 2       | 10 | 16 |
| 11   | 6        | 13 | 24 81 | 4        | 40 | 45 | 2       | 13 | 27 |
| 12   | 6        | 26 | 35 6  | 4        | 47 | 26 | 2       | 16 | 37 |
| 13   | 7        | 9  | 45 41 | 4        | 54 | 7  | 2       | 19 | 48 |
| 14   | 7        | 22 | 56 15 | 5        | 0  | 48 | 2       | 22 | 59 |
| 15   | 8        | 6  | 6 50  | 5        | 7  | 29 | 2       | 26 | 9  |
| 16   | 8        | 19 | 17 26 | 5        | 10 | 10 | 2       | 29 | 20 |
| 17   | 9        | 2  | 28 1  | 5        | 20 | 51 | 2       | 32 | 30 |
| 18   | 9        | 15 | 38 36 | 5        | 27 | 32 | 2       | 35 | 41 |
| 19   | 9        | 28 | 49 11 | 5        | 34 | 13 | 2       | 38 | 51 |
| 20   | 10       | 11 | 59 46 | 5        | 40 | 54 | 2       | 42 | 2  |
| 21   | 10       | 25 | 10 21 | 5        | 47 | 36 | 2       | 45 | 13 |
| 22   | 11       | 8  | 20 56 | 5        | 54 | 17 | 2       | 48 | 23 |
| 23   | 11       | 21 | 31 31 | 6        | 0  | 58 | 2       | 51 | 34 |
| 24   | 0        | 4  | 42 6  | 6        | 7  | 39 | 2       | 54 | 45 |
| 25   | 0        | 17 | 52 41 | 6        | 14 | 20 | 2       | 57 | 55 |
| 26   | 1        | 1  | 3 16  | 6        | 21 | 1  | 3       | 1  | 6  |
| 27   | 1        | 14 | 13 51 | 6        | 27 | 42 | 3       | 4  | 16 |
| 28   | 1        | 27 | 24 26 | 6        | 34 | 23 | 3       | 7  | 27 |
| 29   | 2        | 10 | 35 1  | 6        | 41 | 4  | 3       | 10 | 38 |



( 55 )  
in Months and Days.

MARCH.

| Com-<br>mon | Long. D. |    |    |    | Apog. D. |    |    | Node D. |    |    | Differ |
|-------------|----------|----|----|----|----------|----|----|---------|----|----|--------|
|             | s.       | o  | i  | "  | o        | i  | "  | o       | i  | "  |        |
| 1           | 2        | 10 | 35 | 1  | 6        | 41 | 4  | 3       | 10 | 38 | 0      |
| 2           | 2        | 23 | 43 | 36 | 6        | 47 | 45 | 3       | 13 | 49 | 1      |
| 3           | 3        | 6  | 56 | 11 | 6        | 54 | 26 | 3       | 16 | 59 | 2      |
| 4           | 3        | 20 | 6  | 46 | 7        | 1  | 7  | 3       | 20 | 10 | 3      |
| 5           | 4        | 3  | 17 | 21 | 7        | 7  | 48 | 3       | 23 | 20 | 4      |
| 6           | 4        | 6  | 27 | 56 | 7        | 14 | 29 | 3       | 26 | 31 | 5      |
| 7           | 4        | 29 | 38 | 31 | 7        | 21 | 11 | 3       | 29 | 42 | 6      |
| 8           | 5        | 12 | 49 | 6  | 7        | 27 | 52 | 3       | 32 | 52 | 7      |
| 9           | 5        | 25 | 59 | 41 | 7        | 34 | 33 | 3       | 36 | 3  | 8      |
| 10          | 6        | 9  | 10 | 16 | 7        | 41 | 14 | 3       | 39 | 14 | 9      |
| 11          | 6        | 22 | 20 | 51 | 7        | 47 | 55 | 3       | 42 | 25 | 10     |
| 12          | 7        | 5  | 31 | 26 | 7        | 54 | 36 | 3       | 45 | 36 | 11     |
| 13          | 7        | 18 | 42 | 1  | 8        | 1  | 17 | 3       | 48 | 46 | 12     |
| 14          | 8        | 1  | 52 | 36 | 8        | 7  | 58 | 3       | 51 | 56 | 13     |
| 15          | 8        | 15 | 3  | 11 | 8        | 14 | 39 | 3       | 55 | 7  | 14     |
| 16          | 8        | 28 | 13 | 46 | 8        | 21 | 20 | 3       | 58 | 18 | 15     |
| 17          | 9        | 11 | 24 | 21 | 8        | 28 | 1  | 4       | 1  | 28 | 16     |
| 18          | 9        | 24 | 34 | 56 | 8        | 34 | 42 | 4       | 4  | 39 | 17     |
| 19          | 10       | 7  | 45 | 31 | 8        | 41 | 23 | 4       | 7  | 49 | 18     |
| 20          | 10       | 20 | 56 | 7  | 8        | 48 | 4  | 4       | 11 | 0  | 19     |
| 21          | 11       | 4  | 6  | 42 | 8        | 54 | 45 | 4       | 14 | 11 | 20     |
| 22          | 11       | 17 | 17 | 17 | 9        | 1  | 27 | 4       | 17 | 22 | 21     |
| 23          | 0        | 0  | 27 | 52 | 9        | 8  | 8  | 4       | 20 | 32 | 22     |
| 24          | 0        | 13 | 38 | 27 | 9        | 14 | 49 | 4       | 23 | 43 | 23     |
| 25          | 0        | 26 | 49 | 2  | 9        | 21 | 30 | 4       | 26 | 53 | 24     |
| 26          | 1        | 9  | 59 | 37 | 9        | 28 | 11 | 4       | 30 | 4  | 25     |
| 27          | 1        | 23 | 10 | 12 | 9        | 34 | 52 | 4       | 33 | 15 | 26     |
| 28          | 2        | 6  | 20 | 47 | 9        | 41 | 33 | 4       | 36 | 25 | 27     |
| 29          | 2        | 19 | 31 | 22 | 9        | 48 | 14 | 4       | 39 | 36 | 28     |
| 30          | 3        | 2  | 41 | 57 | 9        | 54 | 55 | 4       | 42 | 47 | 29     |
| 31          | 3        | 15 | 52 | 32 | 10       | 1  | 36 | 4       | 45 | 58 | 30     |

## The Mean Motion of the Moon

## A P R I L

| Com-<br>mon | Long D. |    |    |     | Apoq D. |    |    |     | Node D. |    |    |     | Index |
|-------------|---------|----|----|-----|---------|----|----|-----|---------|----|----|-----|-------|
|             | °       | '  | "  | ''' | °       | '  | "  | ''' | °       | '  | "  | ''' |       |
| 1           | 3       | 29 | 3  | 7   | 10      | 8  | 17 |     | 4       | 49 | 8  |     | 10    |
| 2           | 4       | 12 | 13 | 42  | 10      | 14 | 58 |     | 4       | 52 | 11 |     | 11    |
| 3           | 4       | 25 | 24 | 17  | 10      | 21 | 39 |     | 4       | 55 | 29 |     | 12    |
| 4           | 5       | 8  | 34 | 52  | 10      | 28 | 20 |     | 4       | 58 | 40 |     | 13    |
| 5           | 5       | 21 | 45 | 27  | 10      | 35 | 2  |     | 5       | 1  | 51 |     | 14    |
| 6           | 6       | 4  | 56 | 2   | 10      | 41 | 43 |     | 5       | 5  | 1  |     | 15    |
| 7           | 6       | 18 | 6  | 38  | 10      | 48 | 24 |     | 5       | 8  | 12 |     | 16    |
| 8           | 7       | 1  | 17 | 12  | 10      | 55 | 5  |     | 5       | 11 | 22 |     | 17    |
| 9           | 7       | 14 | 27 | 47  | 11      | 1  | 46 |     | 5       | 14 | 33 |     | 18    |
| 10          | 7       | 27 | 38 | 22  | 11      | 8  | 27 |     | 5       | 17 | 44 |     | 19    |
| 11          | 8       | 10 | 48 | 57  | 11      | 15 | 8  |     | 5       | 20 | 54 |     | 20    |
| 12          | 8       | 23 | 59 | 32  | 11      | 21 | 49 |     | 5       | 24 | 5  |     | 21    |
| 13          | 9       | 7  | 10 | 7   | 11      | 28 | 30 |     | 5       | 27 | 16 |     | 22    |
| 14          | 9       | 20 | 20 | 42  | 11      | 35 | 11 |     | 5       | 30 | 26 |     | 23    |
| 15          | 10      | 3  | 31 | 17  | 11      | 41 | 52 |     | 5       | 33 | 37 |     | 24    |
| 16          | 10      | 16 | 41 | 52  | 11      | 48 | 33 |     | 5       | 36 | 48 |     | 25    |
| 17          | 10      | 29 | 52 | 27  | 11      | 55 | 14 |     | 5       | 39 | 58 |     | 26    |
| 18          | 11      | 13 | 3  | 2   | 12      | 1  | 55 |     | 5       | 43 | 9  |     | 27    |
| 19          | 11      | 26 | 13 | 37  | 12      | 8  | 36 |     | 5       | 46 | 15 |     | 28    |
| 20          | 0       | 9  | 24 | 12  | 12      | 15 | 18 |     | 5       | 49 | 31 |     | 29    |
| 21          | 0       | 22 | 34 | 47  | 12      | 21 | 59 |     | 5       | 52 | 41 |     | 30    |
| 22          | 1       | 5  | 45 | 22  | 12      | 28 | 40 |     | 5       | 55 | 52 |     | 31    |
| 23          | 1       | 18 | 55 | 47  | 12      | 35 | 21 |     | 5       | 59 | 2  |     | 32    |
| 24          | 2       | 2  | 6  | 32  | 12      | 42 | 2  |     | 6       | 2  | 13 |     | 33    |
| 25          | 2       | 15 | 17 | 7   | 12      | 48 | 43 |     | 6       | 5  | 54 |     | 34    |
| 26          | 2       | 28 | 27 | 42  | 12      | 55 | 24 |     | 6       | 8  | 34 |     | 35    |
| 27          | 3       | 11 | 38 | 17  | 13      | 2  | 5  |     | 6       | 11 | 45 |     | 36    |
| 28          | 3       | 24 | 48 | 52  | 13      | 8  | 46 |     | 6       | 14 | 56 |     | 37    |
| 29          | 4       | 7  | 59 | 27  | 13      | 15 | 27 |     | 6       | 18 | 6  |     | 38    |
| 30          | 4       | 21 | 10 | 3   | 13      | 22 | 8  |     | 6       | 21 | 17 |     | 39    |
| 31          | 5       | 4  | 20 | 37  | 13      | 28 | 49 |     | 6       | 24 | 27 |     | 40    |

( 357 )

Moon in Months and Days.

M A Y.

| Com-<br>mon | Long. D. |    |    |    | Apog. D. |    |    | Node D. |    |    | Bisex |
|-------------|----------|----|----|----|----------|----|----|---------|----|----|-------|
|             | S.       | o  | 1  | 11 | o        | 1  | 11 | o       | 1  | 11 |       |
| 1           | 3        | 4  | 20 | 37 | 13       | 28 | 49 | 6       | 24 | 27 | 0     |
| 2           | 3        | 17 | 31 | 12 | 13       | 35 | 30 | 6       | 27 | 38 | 1     |
| 3           | 6        | 0  | 41 | 47 | 13       | 42 | 11 | 6       | 30 | 48 | 2     |
| 4           | 6        | 13 | 52 | 22 | 13       | 48 | 52 | 6       | 33 | 59 | 3     |
| 5           | 6        | 27 | 2  | 57 | 13       | 55 | 34 | 6       | 37 | 10 | 4     |
| 6           | 7        | 10 | 13 | 32 | 14       | 2  | 15 | 6       | 40 | 20 | 5     |
| 7           | 7        | 23 | 24 | 7  | 14       | 8  | 56 | 6       | 43 | 31 | 6     |
| 8           | 8        | 6  | 34 | 42 | 14       | 15 | 37 | 6       | 46 | 41 | 7     |
| 9           | 8        | 19 | 45 | 17 | 14       | 22 | 18 | 6       | 49 | 52 | 8     |
| 10          | 9        | 2  | 55 | 53 | 14       | 28 | 59 | 6       | 53 | 3  | 9     |
| 11          | 9        | 16 | 6  | 27 | 14       | 35 | 40 | 6       | 56 | 14 | 10    |
| 12          | 9        | 29 | 17 | 3  | 14       | 42 | 21 | 6       | 59 | 24 | 11    |
| 13          | 10       | 12 | 27 | 38 | 14       | 49 | 2  | 7       | 2  | 34 | 12    |
| 14          | 10       | 25 | 38 | 13 | 14       | 55 | 43 | 7       | 5  | 45 | 13    |
| 15          | 11       | 8  | 48 | 48 | 15       | 2  | 24 | 7       | 8  | 56 | 14    |
| 16          | 11       | 21 | 59 | 23 | 15       | 9  | 5  | 7       | 12 | 6  | 15    |
| 17          | 0        | 5  | 9  | 58 | 15       | 15 | 46 | 7       | 15 | 17 | 16    |
| 18          | 0        | 18 | 20 | 33 | 15       | 22 | 28 | 7       | 18 | 27 | 17    |
| 19          | 1        | 1  | 31 | 8  | 15       | 29 | 9  | 7       | 21 | 38 | 18    |
| 20          | 1        | 14 | 41 | 43 | 15       | 35 | 50 | 7       | 24 | 49 | 19    |
| 21          | 1        | 27 | 52 | 18 | 15       | 42 | 31 | 7       | 28 | 0  | 20    |
| 22          | 2        | 11 | 2  | 53 | 15       | 49 | 12 | 7       | 31 | 10 | 21    |
| 23          | 2        | 24 | 13 | 28 | 15       | 55 | 53 | 7       | 34 | 21 | 22    |
| 24          | 3        | 7  | 24 | 3  | 16       | 2  | 34 | 7       | 37 | 32 | 23    |
| 25          | 3        | 20 | 34 | 38 | 16       | 9  | 15 | 7       | 40 | 43 | 24    |
| 26          | 4        | 8  | 45 | 13 | 16       | 15 | 56 | 7       | 43 | 53 | 25    |
| 27          | 4        | 16 | 55 | 48 | 16       | 22 | 37 | 7       | 47 | 4  | 26    |
| 28          | 5        | 0  | 6  | 23 | 16       | 29 | 18 | 7       | 50 | 14 | 27    |
| 29          | 5        | 13 | 16 | 58 | 16       | 35 | 59 | 7       | 53 | 25 | 28    |
| 30          | 5        | 26 | 27 | 33 | 16       | 42 | 40 | 7       | 56 | 36 | 29    |
| 31          | 6        | 9  | 38 | 8  | 16       | 49 | 21 | 7       | 59 | 46 | 30    |



( 58 )

## The Mean Motion of the Moon

J U N E.

| Com-<br>mon | Long D. |    |    |     | Apog. D. |    |    |     | Node D. |    |    |     | Bifex |
|-------------|---------|----|----|-----|----------|----|----|-----|---------|----|----|-----|-------|
|             | °       | '  | "  | ''' | °        | '  | "  | ''' | °       | '  | "  | ''' |       |
| 1           | 6       | 22 | 48 | 43  | 16       | 56 | 3  |     | 8       | 2  | 56 |     | 0     |
| 2           | 7       | 5  | 59 | 18  | 17       | 2  | 44 |     | 8       | 6  | 7  |     | 1     |
| 3           | 7       | 19 | 9  | 53  | 17       | 9  | 25 |     | 8       | 9  | 18 |     | 2     |
| 4           | 8       | 2  | 20 | 28  | 17       | 16 | 6  |     | 8       | 12 | 29 |     | 3     |
| 5           | 8       | 15 | 31 | 3   | 17       | 22 | 47 |     | 8       | 15 | 39 |     | 4     |
| 6           | 8       | 28 | 41 | 38  | 17       | 29 | 28 |     | 8       | 18 | 50 |     | 5     |
| 7           | 9       | 11 | 52 | 13  | 17       | 36 | 9  |     | 8       | 22 | 0  |     | 6     |
| 8           | 9       | 25 | 2  | 48  | 17       | 42 | 50 |     | 8       | 25 | 11 |     | 7     |
| 9           | 10      | 8  | 13 | 23  | 17       | 49 | 31 |     | 8       | 28 | 22 |     | 8     |
| 10          | 10      | 21 | 23 | 58  | 17       | 56 | 12 |     | 8       | 31 | 32 |     | 9     |
| 11          | 11      | 4  | 34 | 33  | 18       | 2  | 53 |     | 8       | 34 | 43 |     | 10    |
| 12          | 11      | 17 | 45 | 8   | 18       | 9  | 34 |     | 8       | 37 | 54 |     | 11    |
| 13          | 0       | 0  | 55 | 43  | 18       | 16 | 15 |     | 8       | 41 | 5  |     | 12    |
| 14          | 0       | 14 | 6  | 18  | 18       | 22 | 56 |     | 8       | 44 | 16 |     | 13    |
| 15          | 0       | 27 | 16 | 53  | 18       | 29 | 37 |     | 8       | 47 | 26 |     | 14    |
| 16          | 1       | 10 | 27 | 28  | 18       | 36 | 19 |     | 8       | 50 | 37 |     | 15    |
| 17          | 1       | 23 | 38 | 3   | 18       | 43 | 0  |     | 8       | 53 | 47 |     | 16    |
| 18          | 2       | 6  | 48 | 38  | 18       | 49 | 41 |     | 8       | 56 | 58 |     | 17    |
| 19          | 2       | 19 | 59 | 13  | 18       | 52 | 22 |     | 9       | 0  | 9  |     | 18    |
| 20          | 3       | 3  | 9  | 48  | 19       | 3  | 3  |     | 9       | 3  | 19 |     | 19    |
| 21          | 3       | 16 | 20 | 23  | 19       | 9  | 44 |     | 9       | 6  | 30 |     | 20    |
| 22          | 3       | 29 | 30 | 58  | 19       | 16 | 25 |     | 9       | 9  | 40 |     | 21    |
| 23          | 4       | 12 | 41 | 33  | 19       | 23 | 16 |     | 9       | 12 | 51 |     | 22    |
| 24          | 4       | 25 | 52 | 8   | 19       | 29 | 47 |     | 9       | 16 | 2  |     | 23    |
| 25          | 5       | 9  | 2  | 43  | 19       | 36 | 28 |     | 9       | 19 | 12 |     | 24    |
| 26          | 5       | 22 | 13 | 18  | 19       | 43 | 9  |     | 9       | 22 | 23 |     | 25    |
| 27          | 6       | 5  | 23 | 53  | 19       | 49 | 50 |     | 9       | 25 | 34 |     | 26    |
| 28          | 6       | 18 | 34 | 28  | 19       | 56 | 31 |     | 9       | 28 | 45 |     | 27    |
| 29          | 7       | 1  | 45 | 4   | 20       | 3  | 12 |     | 9       | 31 | 55 |     | 28    |
| 30          | 7       | 14 | 55 | 39  | 20       | 9  | 54 |     | 9       | 35 | 6  |     | 29    |
| 31          | 7       | 28 | 6  | 14  | 20       | 16 | 35 |     | 9       | 38 | 16 |     | 30    |

( 59 )  
in Months and Days.

JULY.

| Com-<br>mon | Long. D. |    |    |    | Apog. D. |    |    | Node D. |    |    | Bisex |
|-------------|----------|----|----|----|----------|----|----|---------|----|----|-------|
|             | f.       | o  | i  | "  | o        | i  | "  | o       | i  | "  |       |
| 1           | 7        | 28 | 6  | 14 | 20       | 16 | 35 | 9       | 38 | 16 | 0     |
| 2           | 8        | 11 | 16 | 49 | 20       | 23 | 16 | 9       | 41 | 27 | 1     |
| 3           | 8        | 24 | 27 | 24 | 20       | 29 | 57 | 9       | 44 | 37 | 2     |
| 4           | 9        | 7  | 37 | 59 | 20       | 36 | 38 | 9       | 47 | 48 | 3     |
| 5           | 9        | 20 | 48 | 34 | 20       | 43 | 19 | 9       | 50 | 59 | 4     |
| 6           | 10       | 3  | 59 | 9  | 20       | 50 | 0  | 9       | 54 | 9  | 5     |
| 7           | 10       | 17 | 9  | 44 | 20       | 56 | 41 | 9       | 57 | 20 | 6     |
| 8           | 11       | 0  | 20 | 19 | 21       | 3  | 22 | 10      | 0  | 30 | 7     |
| 9           | 11       | 13 | 30 | 54 | 21       | 10 | 3  | 10      | 3  | 41 | 8     |
| 10          | 11       | 26 | 41 | 29 | 21       | 16 | 44 | 10      | 6  | 51 | 9     |
| 11          | 0        | 9  | 52 | 4  | 21       | 23 | 25 | 10      | 10 | 2  | 10    |
| 12          | 0        | 23 | 2  | 39 | 21       | 30 | 6  | 10      | 13 | 13 | 11    |
| 13          | 1        | 6  | 13 | 14 | 21       | 36 | 47 | 10      | 16 | 24 | 12    |
| 14          | 1        | 19 | 23 | 49 | 21       | 43 | 28 | 10      | 19 | 35 | 13    |
| 15          | 2        | 2  | 34 | 24 | 21       | 50 | 9  | 10      | 22 | 45 | 14    |
| 16          | 2        | 15 | 44 | 59 | 21       | 56 | 52 | 10      | 25 | 56 | 15    |
| 17          | 2        | 28 | 55 | 34 | 22       | 3  | 32 | 10      | 29 | 6  | 16    |
| 18          | 3        | 12 | 6  | 9  | 22       | 10 | 13 | 10      | 32 | 17 | 17    |
| 19          | 3        | 25 | 16 | 44 | 22       | 16 | 54 | 10      | 35 | 28 | 18    |
| 20          | 4        | 8  | 27 | 19 | 22       | 23 | 35 | 10      | 38 | 39 | 19    |
| 21          | 4        | 21 | 37 | 54 | 22       | 30 | 15 | 10      | 41 | 49 | 20    |
| 22          | 5        | 4  | 48 | 29 | 22       | 36 | 56 | 10      | 45 | 0  | 21    |
| 23          | 5        | 17 | 59 | 4  | 22       | 43 | 37 | 10      | 48 | 11 | 22    |
| 24          | 6        | 1  | 9  | 39 | 22       | 50 | 19 | 10      | 51 | 21 | 23    |
| 25          | 6        | 14 | 20 | 14 | 22       | 57 | 0  | 10      | 54 | 32 | 24    |
| 26          | 6        | 27 | 30 | 49 | 23       | 3  | 41 | 10      | 57 | 42 | 25    |
| 27          | 7        | 10 | 41 | 20 | 23       | 10 | 22 | 11      | 0  | 53 | 26    |
| 28          | 7        | 23 | 51 | 59 | 23       | 17 | 3  | 11      | 4  | 3  | 27    |
| 29          | 8        | 7  | 2  | 34 | 23       | 23 | 44 | 11      | 7  | 14 | 28    |
| 30          | 8        | 20 | 13 | 9  | 23       | 30 | 25 | 11      | 10 | 25 | 29    |
| 31          | 9        | 3  | 23 | 44 | 23       | 37 | 6  | 11      | 13 | 36 | 30    |

( 60 )

## The Mean Motion of the Moon

AUGUST.

| Com-<br>mon | Long. D. |          |          |          | Agog. D. |          |          | Node D.  |          |          | Bifex |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
|             | <i>f</i> | <i>o</i> | <i>i</i> | <i>u</i> | <i>o</i> | <i>i</i> | <i>u</i> | <i>o</i> | <i>i</i> | <i>u</i> |       |
| 1           | 9        | 16       | 34       | 19       | 23       | 43       | 47       | 11       | 16       | 47       | 0     |
| 2           | 9        | 29       | 44       | 54       | 23       | 50       | 28       | 11       | 19       | 58       | 1     |
| 3           | 10       | 12       | 55       | 29       | 23       | 57       | 9        | 11       | 23       | 8        | 2     |
| 4           | 10       | 26       | 6        | 4        | 24       | 3        | 51       | 11       | 26       | 19       | 3     |
| 5           | 11       | 9        | 16       | 39       | 24       | 10       | 32       | 11       | 29       | 29       | 4     |
| 6           | 11       | 22       | 27       | 14       | 24       | 17       | 30       | 11       | 32       | 40       | 5     |
| 7           | 0        | 5        | 37       | 49       | 24       | 23       | 54       | 11       | 35       | 51       | 6     |
| 8           | 0        | 18       | 48       | 24       | 24       | 30       | 35       | 11       | 39       | 2        | 7     |
| 9           | 1        | 1        | 58       | 59       | 24       | 37       | 16       | 11       | 42       | 12       | 8     |
| 10          | 1        | 15       | 9        | 34       | 24       | 43       | 57       | 11       | 45       | 23       | 9     |
| 11          | 1        | 28       | 20       | 9        | 24       | 50       | 38       | 11       | 48       | 33       | 10    |
| 12          | 2        | 11       | 30       | 44       | 24       | 57       | 19       | 11       | 51       | 44       | 11    |
| 13          | 2        | 24       | 41       | 19       | 25       | 4        | 0        | 11       | 54       | 54       | 12    |
| 14          | 3        | 7        | 51       | 54       | 25       | 10       | 42       | 11       | 58       | 5        | 13    |
| 15          | 3        | 21       | 2        | 29       | 25       | 17       | 23       | 12       | 1        | 15       | 14    |
| 16          | 4        | 4        | 13       | 4        | 25       | 24       | 4        | 12       | 4        | 26       | 15    |
| 17          | 4        | 17       | 23       | 40       | 25       | 30       | 45       | 12       | 7        | 36       | 16    |
| 18          | 5        | 0        | 34       | 15       | 25       | 37       | 26       | 12       | 10       | 47       | 17    |
| 19          | 5        | 13       | 44       | 50       | 25       | 44       | 7        | 12       | 13       | 58       | 18    |
| 20          | 5        | 26       | 55       | 25       | 25       | 50       | 48       | 12       | 17       | 8        | 19    |
| 21          | 6        | 10       | 6        | 0        | 25       | 57       | 29       | 12       | 20       | 19       | 20    |
| 22          | 6        | 23       | 16       | 35       | 26       | 4        | 10       | 12       | 23       | 29       | 21    |
| 23          | 7        | 6        | 27       | 10       | 26       | 10       | 51       | 12       | 26       | 40       | 22    |
| 24          | 7        | 19       | 37       | 45       | 26       | 17       | 32       | 12       | 29       | 51       | 23    |
| 25          | 8        | 2        | 48       | 20       | 26       | 24       | 13       | 12       | 33       | 1        | 24    |
| 26          | 8        | 15       | 58       | 55       | 26       | 30       | 55       | 12       | 36       | 12       | 25    |
| 27          | 8        | 29       | 9        | 30       | 26       | 37       | 36       | 12       | 39       | 23       | 26    |
| 28          | 9        | 12       | 20       | 5        | 26       | 44       | 17       | 12       | 42       | 34       | 27    |
| 29          | 9        | 25       | 30       | 40       | 26       | 50       | 58       | 12       | 45       | 44       | 28    |
| 30          | 10       | 8        | 41       | 15       | 26       | 57       | 39       | 12       | 48       | 55       | 29    |
| 31          | 10       | 21       | 51       | 50       | 27       | 4        | 20       | 12       | 52       | 5        | 30    |



( 61 )  
in Months and Days.

SEPTEMBER.

| Com-<br>mon | Long. D. |    |    |    | Apog. D. |    |    |    | Node D. |    |    |    | Biffer |
|-------------|----------|----|----|----|----------|----|----|----|---------|----|----|----|--------|
|             | f.       | o  | i  | "  | f.       | o  | i  | "  | o       | i  | "  |    |        |
| 1           | 11       | 5  | 2  | 25 | 0        | 27 | 11 | 1  | 12      | 55 | 16 | 0  |        |
| 2           | 11       | 18 | 13 | 0  | 0        | 27 | 17 | 42 | 12      | 58 | 27 | 1  |        |
| 3           | 0        | 1  | 23 | 35 | 0        | 27 | 24 | 23 | 13      | 1  | 37 | 2  |        |
| 4           | 0        | 14 | 34 | 10 | 0        | 27 | 31 | 4  | 13      | 4  | 48 | 3  |        |
| 5           | 0        | 27 | 44 | 45 | 0        | 27 | 37 | 45 | 13      | 7  | 58 | 4  |        |
| 6           | 1        | 10 | 55 | 20 | 0        | 27 | 44 | 26 | 13      | 11 | 9  | 5  |        |
| 7           | 1        | 24 | 5  | 55 | 0        | 27 | 51 | 7  | 13      | 14 | 20 | 6  |        |
| 8           | 2        | 7  | 16 | 30 | 0        | 27 | 57 | 48 | 13      | 17 | 31 | 7  |        |
| 9           | 2        | 20 | 27 | 5  | 0        | 28 | 4  | 29 | 13      | 20 | 41 | 8  |        |
| 10          | 3        | 3  | 37 | 40 | 0        | 28 | 11 | 11 | 13      | 23 | 52 | 9  |        |
| 11          | 3        | 16 | 48 | 15 | 0        | 28 | 17 | 52 | 13      | 27 | 3  | 10 |        |
| 12          | 3        | 29 | 58 | 50 | 0        | 28 | 24 | 33 | 13      | 30 | 14 | 11 |        |
| 13          | 4        | 13 | 9  | 25 | 0        | 28 | 31 | 14 | 13      | 33 | 24 | 12 |        |
| 14          | 4        | 26 | 20 | 0  | 0        | 28 | 37 | 55 | 13      | 36 | 35 | 13 |        |
| 15          | 5        | 9  | 30 | 35 | 0        | 28 | 44 | 36 | 13      | 39 | 45 | 14 |        |
| 16          | 5        | 22 | 41 | 10 | 0        | 28 | 51 | 17 | 13      | 42 | 56 | 15 |        |
| 17          | 6        | 5  | 51 | 45 | 0        | 28 | 57 | 58 | 13      | 46 | 7  | 16 |        |
| 18          | 6        | 19 | 2  | 20 | 0        | 29 | 4  | 39 | 13      | 49 | 17 | 17 |        |
| 19          | 7        | 2  | 12 | 55 | 0        | 29 | 11 | 20 | 13      | 52 | 28 | 18 |        |
| 20          | 7        | 15 | 23 | 30 | 0        | 29 | 18 | 1  | 13      | 55 | 38 | 19 |        |
| 21          | 7        | 28 | 34 | 5  | 0        | 29 | 24 | 42 | 13      | 58 | 49 | 20 |        |
| 22          | 8        | 11 | 44 | 40 | 0        | 29 | 31 | 23 | 14      | 2  | 0  | 21 |        |
| 23          | 8        | 28 | 55 | 15 | 0        | 29 | 38 | 4  | 14      | 5  | 10 | 22 |        |
| 24          | 9        | 8  | 5  | 50 | 0        | 29 | 44 | 45 | 14      | 8  | 21 | 23 |        |
| 25          | 9        | 21 | 16 | 25 | 0        | 29 | 51 | 27 | 14      | 11 | 31 | 24 |        |
| 26          | 10       | 4  | 27 | 0  | 0        | 29 | 58 | 8  | 14      | 14 | 42 | 25 |        |
| 27          | 10       | 17 | 37 | 35 | 1        | 0  | 4  | 49 | 14      | 17 | 53 | 26 |        |
| 28          | 11       | 0  | 48 | 10 | 1        | 0  | 11 | 30 | 14      | 21 | 3  | 27 |        |
| 29          | 11       | 13 | 58 | 45 | 1        | 0  | 18 | 11 | 14      | 24 | 14 | 28 |        |
| 30          | 11       | 27 | 9  | 20 | 1        | 0  | 24 | 52 | 14      | 27 | 24 | 29 |        |
| 31          | 0        | 10 | 19 | 55 | 1        | 0  | 31 | 33 | 14      | 30 | 35 | 30 |        |

## The Mean Motion of the Moon

OCTOBER. 1882

| Com-<br>mon | Long. D.            | Apog. D.            | Node D.   | Differ |
|-------------|---------------------|---------------------|-----------|--------|
|             | <i>f.</i> °   '   " | <i>f.</i> °   '   " | °   '   " |        |
| 1           | 0 10 19 55          | 1 0 31 33           | 14 30 25  | 0      |
| 2           | 0 23 30 30          | 1 0 38 14           | 14 33 46  | 1      |
| 3           | 1 6 41 5            | 1 0 44 55           | 14 36 56  | 2      |
| 4           | 1 19 51 40          | 1 0 51 36           | 14 40 7   | 3      |
| 5           | 2 3 2 15            | 1 0 58 17           | 14 43 17  | 4      |
| 6           | 2 16 12 50          | 1 1 4 58            | 14 46 28  | 5      |
| 7           | 2 29 23 26          | 1 1 11 39           | 14 49 39  | 6      |
| 8           | 3 12 34 1           | 1 1 18 20           | 14 52 50  | 7      |
| 9           | 3 25 44 36          | 1 1 25 2            | 14 56 0   | 8      |
| 10          | 4 8 55 11           | 1 1 31 43           | 14 59 11  | 9      |
| 11          | 4 22 5 46           | 1 1 38 24           | 15 2 21   | 10     |
| 12          | 5 5 16 21           | 1 1 45 5            | 15 5 32   | 11     |
| 13          | 5 8 26 56           | 1 1 51 46           | 15 8 43   | 12     |
| 14          | 6 1 37 31           | 1 1 58 27           | 15 11 53  | 13     |
| 15          | 6 14 48 6           | 1 2 5 8             | 15 15 4   | 14     |
| 16          | 6 27 58 41          | 1 2 11 49           | 15 18 15  | 15     |
| 17          | 7 11 9 16           | 1 2 18 30           | 15 21 26  | 16     |
| 18          | 7 24 19 51          | 1 2 25 11           | 15 24 36  | 17     |
| 19          | 8 7 30 26           | 1 2 31 52           | 15 27 47  | 18     |
| 20          | 8 20 41 1           | 1 2 38 33           | 15 30 57  | 19     |
| 21          | 9 3 51 36           | 1 2 45 14           | 15 34 8   | 20     |
| 22          | 9 17 2 11           | 1 2 51 55           | 15 37 19  | 21     |
| 23          | 10 0 12 46          | 1 2 58 36           | 15 40 29  | 22     |
| 24          | 10 13 23 21         | 1 3 5 17            | 15 43 40  | 23     |
| 25          | 10 26 33 56         | 1 3 11 58           | 15 46 50  | 24     |
| 26          | 11 9 44 31          | 1 3 18 39           | 15 50 1   | 25     |
| 27          | 11 22 55 6          | 1 3 25 21           | 15 53 12  | 26     |
| 28          | 0 6 5 41            | 1 3 32 2            | 15 56 22  | 27     |
| 29          | 0 19 16 16          | 1 3 38 43           | 15 59 33  | 28     |
| 30          | 1 2 26 51           | 1 3 45 24           | 16 2 43   | 29     |
| 31          | 1 15 37 26          | 1 3 52 5            | 16 5 54   | 30     |

( 63 )

in Months and Days.

## NOVEMBER.

| Com-<br>mon | Long. D. |    |    |    | Apog. D. |   |    |    | Node D. |    |    |    | Biflex |
|-------------|----------|----|----|----|----------|---|----|----|---------|----|----|----|--------|
|             | f.       | o  | i  | "  | f.       | o | i  | "  | o       | i  | "  |    |        |
| 1           | 1        | 28 | 48 | 1  | 1        | 3 | 58 | 46 | 16      | 9  | 5  | 0  |        |
| 2           | 2        | 11 | 58 | 36 | 1        | 4 | 5  | 27 | 16      | 12 | 16 | 1  |        |
| 3           | 2        | 25 | 9  | 11 | 1        | 4 | 12 | 8  | 16      | 15 | 26 | 2  |        |
| 4           | 3        | 8  | 19 | 46 | 1        | 4 | 18 | 49 | 16      | 18 | 37 | 3  |        |
| 5           | 3        | 21 | 30 | 21 | 1        | 4 | 25 | 30 | 16      | 21 | 48 | 4  |        |
| 6           | 4        | 4  | 40 | 56 | 1        | 4 | 32 | 11 | 16      | 24 | 59 | 5  |        |
| 7           | 4        | 17 | 51 | 31 | 1        | 4 | 38 | 53 | 16      | 28 | 9  | 6  |        |
| 8           | 5        | 1  | 2  | 6  | 1        | 4 | 45 | 34 | 16      | 31 | 20 | 7  |        |
| 9           | 5        | 14 | 12 | 41 | 1        | 4 | 52 | 15 | 16      | 34 | 30 | 8  |        |
| 10          | 5        | 27 | 23 | 16 | 1        | 4 | 58 | 56 | 16      | 37 | 41 | 9  |        |
| 11          | 6        | 10 | 33 | 51 | 1        | 5 | 5  | 37 | 16      | 40 | 52 | 10 |        |
| 12          | 6        | 23 | 44 | 26 | 1        | 5 | 12 | 10 | 16      | 44 | 2  | 11 |        |
| 13          | 7        | 6  | 55 | 1  | 1        | 5 | 18 | 59 | 16      | 47 | 13 | 12 |        |
| 14          | 7        | 20 | 5  | 36 | 1        | 5 | 25 | 40 | 16      | 50 | 23 | 13 |        |
| 15          | 8        | 3  | 16 | 11 | 1        | 5 | 32 | 21 | 16      | 53 | 34 | 14 |        |
| 16          | 8        | 16 | 26 | 46 | 1        | 5 | 39 | 2  | 16      | 56 | 45 | 15 |        |
| 17          | 8        | 29 | 37 | 21 | 1        | 5 | 45 | 43 | 16      | 59 | 55 | 16 |        |
| 18          | 9        | 12 | 47 | 56 | 1        | 5 | 52 | 24 | 17      | 3  | 6  | 17 |        |
| 19          | 9        | 25 | 58 | 31 | 1        | 5 | 59 | 5  | 17      | 16 | 16 | 18 |        |
| 20          | 10       | 9  | 9  | 16 | 1        | 6 | 5  | 46 | 17      | 9  | 27 | 19 |        |
| 21          | 10       | 22 | 19 | 41 | 1        | 6 | 12 | 27 | 17      | 12 | 38 | 20 |        |
| 22          | 11       | 5  | 30 | 16 | 1        | 6 | 19 | 9  | 17      | 15 | 49 | 21 |        |
| 23          | 11       | 18 | 40 | 51 | 1        | 6 | 25 | 50 | 17      | 18 | 59 | 22 |        |
| 24          | 10       | 1  | 51 | 26 | 1        | 6 | 32 | 31 | 17      | 22 | 10 | 23 |        |
| 25          | 10       | 15 | 2  | 2  | 1        | 6 | 39 | 12 | 17      | 25 | 21 | 24 |        |
| 26          | 10       | 28 | 12 | 37 | 1        | 6 | 45 | 53 | 17      | 28 | 32 | 25 |        |
| 27          | 1        | 11 | 23 | 12 | 1        | 6 | 52 | 34 | 17      | 31 | 42 | 26 |        |
| 28          | 1        | 24 | 33 | 47 | 1        | 6 | 59 | 15 | 17      | 34 | 53 | 27 |        |
| 29          | 2        | 7  | 44 | 22 | 1        | 7 | 5  | 56 | 17      | 38 | 3  | 28 |        |
| 30          | 2        | 20 | 54 | 57 | 1        | 7 | 12 | 37 | 17      | 41 | 14 | 29 |        |
| 31          | 3        | 4  | 5  | 32 | 1        | 7 | 19 | 18 | 17      | 44 | 25 | 30 |        |



## The Mean Motion of the Moon, &amp;c.

## D E C E M B E R.

| Com.<br>mon | Long. D. |    |    |    | Apog. D. |    |    |    | Node D. |    |    | Biflex |
|-------------|----------|----|----|----|----------|----|----|----|---------|----|----|--------|
|             | f.       | o  | '  | "  | f.       | o  | '  | "  | o       | '  | "  |        |
| 1           | 3        | 4  | 5  | 32 | 1        | 7  | 19 | 18 | 17      | 44 | 25 | 0      |
| 2           | 3        | 17 | 16 | 7  | 1        | 7  | 25 | 59 | 17      | 47 | 35 | 1      |
| 3           | 4        | 0  | 26 | 42 | 1        | 7  | 32 | 40 | 17      | 50 | 46 | 2      |
| 4           | 4        | 13 | 37 | 17 | 1        | 7  | 39 | 21 | 17      | 53 | 56 | 3      |
| 5           | 4        | 26 | 47 | 52 | 1        | 7  | 46 | 2  | 17      | 57 | 7  | 4      |
| 6           | 5        | 9  | 58 | 27 | 1        | 7  | 52 | 43 | 18      | 0  | 18 | 5      |
| 7           | 5        | 23 | 9  | 2  | 1        | 7  | 59 | 24 | 18      | 3  | 28 | 6      |
| 8           | 6        | 6  | 19 | 37 | 1        | 8  | 6  | 6  | 18      | 6  | 39 | 7      |
| 9           | 6        | 19 | 30 | 12 | 1        | 8  | 12 | 47 | 18      | 9  | 49 | 8      |
| 10          | 7        | 2  | 40 | 47 | 1        | 8  | 19 | 28 | 18      | 13 | 0  | 9      |
| 11          | 7        | 15 | 51 | 22 | 1        | 8  | 26 | 9  | 18      | 16 | 11 | 10     |
| 12          | 7        | 29 | 1  | 57 | 1        | 8  | 32 | 50 | 18      | 19 | 21 | 11     |
| 13          | 8        | 12 | 12 | 32 | 1        | 8  | 39 | 31 | 18      | 22 | 32 | 12     |
| 14          | 8        | 25 | 23 | 7  | 1        | 8  | 46 | 12 | 18      | 25 | 42 | 13     |
| 15          | 9        | 8  | 33 | 42 | 1        | 8  | 52 | 53 | 18      | 28 | 53 | 14     |
| 16          | 9        | 21 | 44 | 17 | 1        | 8  | 59 | 34 | 18      | 32 | 4  | 15     |
| 17          | 10       | 4  | 54 | 52 | 1        | 9  | 6  | 15 | 18      | 35 | 15 | 16     |
| 18          | 10       | 18 | 5  | 27 | 1        | 9  | 12 | 56 | 18      | 38 | 25 | 17     |
| 19          | 11       | 1  | 16 | 2  | 1        | 9  | 19 | 38 | 18      | 41 | 36 | 18     |
| 20          | 11       | 14 | 26 | 37 | 1        | 9  | 26 | 19 | 18      | 44 | 47 | 19     |
| 21          | 11       | 27 | 37 | 12 | 1        | 9  | 33 | 0  | 18      | 47 | 58 | 20     |
| 22          | 0        | 10 | 47 | 47 | 1        | 9  | 39 | 41 | 18      | 51 | 9  | 21     |
| 23          | 0        | 23 | 58 | 22 | 1        | 9  | 46 | 22 | 18      | 54 | 19 | 22     |
| 24          | 1        | 7  | 8  | 57 | 1        | 9  | 53 | 3  | 18      | 57 | 30 | 23     |
| 25          | 1        | 20 | 19 | 32 | 1        | 9  | 59 | 44 | 19      | 0  | 41 | 24     |
| 26          | 2        | 3  | 30 | 7  | 1        | 10 | 6  | 25 | 19      | 3  | 51 | 25     |
| 27          | 2        | 16 | 40 | 42 | 1        | 10 | 13 | 6  | 19      | 7  | 2  | 26     |
| 28          | 2        | 29 | 51 | 17 | 1        | 10 | 19 | 47 | 19      | 10 | 12 | 27     |
| 29          | 3        | 13 | 1  | 52 | 1        | 10 | 26 | 28 | 19      | 13 | 23 | 28     |
| 30          | 3        | 26 | 12 | 27 | 1        | 10 | 33 | 9  | 19      | 16 | 33 | 29     |
| 31          | 4        | 9  | 23 | 2  | 1        | 10 | 39 | 50 | 19      | 19 | 43 | 30     |

The Moon's mean Motion in Hours,  
Minutes and Seconds.

| H  | Long. D. |    |    | Apog. D. |    |   | Node D. |    |   |
|----|----------|----|----|----------|----|---|---------|----|---|
|    | °        | '  | "  | °        | '  | " | °       | '  | " |
| 1  | 0        | 32 | 56 | 0        | 17 |   | 0       | 8  |   |
| 2  | 1        | 5  | 53 | 0        | 33 |   | 0       | 16 |   |
| 3  | 1        | 38 | 49 | 0        | 50 |   | 0       | 24 |   |
| 4  | 2        | 11 | 46 | 1        | 7  |   | 0       | 32 |   |
| 5  | 2        | 44 | 42 | 1        | 24 |   | 0       | 40 |   |
| 6  | 3        | 17 | 39 | 1        | 40 |   | 0       | 48 |   |
| 7  | 3        | 50 | 35 | 1        | 57 |   | 0       | 56 |   |
| 8  | 4        | 23 | 32 | 2        | 14 |   | 1       | 4  |   |
| 9  | 4        | 56 | 28 | 2        | 30 |   | 1       | 12 |   |
| 10 | 5        | 29 | 25 | 2        | 47 |   | 1       | 19 |   |
| 11 | 6        | 2  | 21 | 3        | 4  |   | 1       | 27 |   |
| 12 | 6        | 35 | 18 | 3        | 21 |   | 1       | 35 |   |
| 13 | 7        | 8  | 14 | 3        | 37 |   | 1       | 43 |   |
| 14 | 7        | 41 | 10 | 3        | 54 |   | 1       | 51 |   |
| 15 | 8        | 14 | 7  | 4        | 11 |   | 1       | 59 |   |
| 16 | 8        | 47 | 3  | 4        | 27 |   | 2       | 7  |   |
| 17 | 9        | 20 | 0  | 4        | 44 |   | 2       | 15 |   |
| 18 | 9        | 52 | 56 | 5        | 1  |   | 2       | 23 |   |
| 19 | 10       | 25 | 53 | 5        | 18 |   | 2       | 31 |   |
| 20 | 10       | 58 | 49 | 5        | 34 |   | 2       | 39 |   |
| 21 | 11       | 31 | 46 | 5        | 51 |   | 2       | 47 |   |
| 22 | 12       | 4  | 42 | 6        | 8  |   | 2       | 55 |   |
| 23 | 12       | 37 | 39 | 6        | 24 |   | 3       | 3  |   |
| 24 | 13       | 10 | 35 | 6        | 41 |   | 3       | 11 |   |
| 25 | 13       | 43 | 32 | 6        | 58 |   | 3       | 19 |   |
| 26 | 14       | 16 | 28 | 7        | 15 |   | 3       | 27 |   |
| 27 | 14       | 49 | 24 | 7        | 31 |   | 3       | 34 |   |
| 28 | 15       | 22 | 21 | 7        | 48 |   | 3       | 42 |   |
| 29 | 15       | 55 | 17 | 8        | 5  |   | 3       | 50 |   |
| 30 | 16       | 28 | 14 | 8        | 21 |   | 3       | 58 |   |

The Moon's mean Motion in Hours,  
Minutes and Seconds, continu'd.

| H  | Long. D. |    |    | Apog. D. |    | Node D. |    |
|----|----------|----|----|----------|----|---------|----|
|    | °        | '  | "  | °        | '  | °       | '  |
|    | 1        | 2  | 3  | 4        | 5  | 6       | 7  |
| 31 | 17       | 28 | 14 | 8        | 38 | 4       | 6  |
| 32 | 17       | 34 | 7  | 8        | 54 | 4       | 14 |
| 33 | 18       | 7  | 3  | 9        | 11 | 4       | 22 |
| 34 | 18       | 39 | 59 | 9        | 28 | 4       | 30 |
| 35 | 19       | 12 | 55 | 9        | 45 | 4       | 38 |
| 36 | 19       | 45 | 52 | 10       | 2  | 4       | 46 |
| 37 | 20       | 18 | 48 | 10       | 19 | 4       | 54 |
| 38 | 20       | 51 | 45 | 10       | 36 | 5       | 2  |
| 39 | 21       | 24 | 41 | 10       | 52 | 5       | 10 |
| 40 | 21       | 27 | 38 | 11       | 8  | 5       | 18 |
| 41 | 22       | 30 | 34 | 11       | 25 | 5       | 26 |
| 42 | 23       | 3  | 31 | 11       | 42 | 5       | 34 |
| 43 | 23       | 36 | 27 | 11       | 59 | 5       | 42 |
| 44 | 24       | 9  | 24 | 12       | 16 | 5       | 50 |
| 45 | 24       | 42 | 20 | 12       | 32 | 5       | 58 |
| 46 | 25       | 15 | 17 | 12       | 48 | 6       | 6  |
| 47 | 25       | 48 | 13 | 13       | 5  | 6       | 14 |
| 48 | 26       | 21 | 10 | 13       | 22 | 6       | 22 |
| 49 | 26       | 54 | 6  | 13       | 39 | 6       | 30 |
| 50 | 27       | 27 | 3  | 13       | 56 | 6       | 38 |
| 51 | 27       | 59 | 59 | 14       | 13 | 6       | 46 |
| 52 | 28       | 32 | 56 | 14       | 30 | 6       | 54 |
| 53 | 29       | 5  | 52 | 14       | 46 | 7       | 1  |
| 54 | 29       | 38 | 49 | 15       | 2  | 7       | 8  |
| 55 | 30       | 11 | 45 | 15       | 19 | 7       | 16 |
| 56 | 30       | 44 | 42 | 15       | 36 | 7       | 24 |
| 57 | 31       | 17 | 38 | 15       | 53 | 7       | 32 |
| 58 | 31       | 50 | 34 | 16       | 10 | 7       | 40 |
| 59 | 32       | 23 | 31 | 16       | 26 | 7       | 48 |
| 60 | 32       | 56 | 27 | 16       | 43 | 7       | 56 |



A Table of the 2d Equation of the Node, and Inclination of the Limit above  $4^{\circ} 59' 35''$ .

| °                | Signs 0 & 6 |    |        |                  | Signs 1 & 7 |       |        |                  | Signs 2 & 8 |   |        |    | ° |
|------------------|-------------|----|--------|------------------|-------------|-------|--------|------------------|-------------|---|--------|----|---|
|                  | Eq. Add.    |    | Incli. |                  | Eq. Add.    |       | Incli. |                  | Eq. Add.    |   | Incli. |    |   |
| 0                | 0           | 0  | 9      | 17 45            | 1           | 16 40 | 13 22  | 1                | 18 41       | 4 | 27     | 30 |   |
| 1                | 0           | 3  | 3      | 17 45            | 1           | 18 13 | 13 6   | 1                | 17 6        | 4 | 11     | 29 |   |
| 2                | 0           | 6  | 6      | 17 44            | 1           | 19 41 | 12 49  | 1                | 15 26       | 3 | 55     | 28 |   |
| 3                | 0           | 9  | 8      | 17 44            | 1           | 21 5  | 12 32  | 1                | 13 41       | 3 | 40     | 27 |   |
| 4                | 0           | 12 | 10     | 17 42            | 1           | 22 20 | 12 15  | 1                | 11 49       | 3 | 25     | 26 |   |
| 5                | 0           | 15 | 11     | 17 40            | 1           | 23 31 | 11 58  | 1                | 9 52        | 3 | 11     | 25 |   |
| 6                | 0           | 18 | 11     | 17 37            | 1           | 24 36 | 11 41  | 1                | 7 59        | 2 | 57     | 24 |   |
| 7                | 0           | 21 | 11     | 17 33            | 1           | 25 34 | 11 24  | 1                | 5 42        | 2 | 43     | 23 |   |
| 8                | 0           | 24 | 7      | 17 28            | 1           | 26 27 | 11 7   | 1                | 3 29        | 2 | 29     | 22 |   |
| 9                | 0           | 27 | 3      | 17 22            | 1           | 27 14 | 10 49  | 1                | 1 11        | 2 | 16     | 21 |   |
| 10               | 0           | 29 | 57     | 17 15            | 1           | 27 54 | 10 31  | 0                | 58 49       | 2 | 4      | 20 |   |
| 11               | 0           | 32 | 48     | 17 8             | 1           | 28 28 | 10 13  | 0                | 56 22       | 1 | 53     | 19 |   |
| 12               | 0           | 35 | 38     | 17 0             | 1           | 28 56 | 9 55   | 0                | 53 51       | 1 | 42     | 18 |   |
| 13               | 0           | 38 | 25     | 16 52            | 1           | 29 17 | 9 37   | 0                | 51 15       | 1 | 31     | 17 |   |
| 14               | 0           | 41 | 10     | 16 44            | 1           | 29 32 | 9 18   | 0                | 48 36       | 1 | 21     | 16 |   |
| 15               | 0           | 43 | 51     | 16 35            | 1           | 29 40 | 8 59   | 0                | 45 53       | 1 | 11     | 15 |   |
| 16               | 0           | 46 | 30     | 16 26            | 1           | 29 40 | 8 40   | 0                | 43 6        | 1 | 2      | 14 |   |
| 17               | 0           | 49 | 5      | 16 17            | 1           | 29 37 | 8 20   | 0                | 40 16       | 0 | 53     | 13 |   |
| 18               | 0           | 51 | 37     | 16 7             | 1           | 29 25 | 8 0    | 0                | 37 22       | 0 | 45     | 12 |   |
| 19               | 0           | 54 | 6      | 15 56            | 1           | 29 7  | 7 40   | 0                | 34 26       | 0 | 38     | 11 |   |
| 20               | 0           | 56 | 31     | 15 44            | 1           | 28 42 | 7 21   | 0                | 31 27       | 0 | 52     | 10 |   |
| 21               | 0           | 58 | 52     | 15 32            | 1           | 28 11 | 7 2    | 0                | 28 25       | 0 | 26     | 9  |   |
| 22               | 1           | 1  | 9      | 15 19            | 1           | 27 33 | 6 44   | 0                | 25 22       | 0 | 21     | 8  |   |
| 23               | 1           | 3  | 22     | 15 6             | 1           | 26 49 | 6 26   | 0                | 22 16       | 0 | 16     | 7  |   |
| 24               | 1           | 5  | 30     | 14 52            | 1           | 25 58 | 6 8    | 0                | 19 8        | 0 | 12     | 6  |   |
| 25               | 1           | 7  | 34     | 14 38            | 1           | 25 0  | 5 50   | 0                | 15 59       | 0 | 8      | 5  |   |
| 26               | 1           | 9  | 32     | 14 24            | 1           | 23 57 | 5 33   | 0                | 12 49       | 0 | 5      | 4  |   |
| 27               | 1           | 11 | 27     | 14 9             | 1           | 22 47 | 5 16   | 0                | 9 38        | 0 | 3      | 3  |   |
| 28               | 1           | 13 | 16     | 13 54            | 1           | 21 31 | 4 59   | 0                | 6 26        | 0 | 1      | 2  |   |
| 29               | 1           | 15 | 1      | 13 38            | 1           | 20 9  | 4 43   | 0                | 3 13        | 0 | 0      | 1  |   |
| 30               | 1           | 16 | 40     | 13 22            | 1           | 18 41 | 4 27   | 0                | 0 0         | 0 | 0      | 0  |   |
| Signs 5 } Subtr. |             |    |        | Signs 4 } Subtr. |             |       |        | Signs 3 } Subtr. |             |   |        |    |   |
| 11               |             |    |        | 10               |             |       |        | 9                |             |   |        |    |   |

A Table of the Simple Latitude of the Moon fitted to the least Inclination of its Orbit, with the Increments to the greatest Inclination.

| Arg. L.        | Latit. |       | Incre-<br>ment<br>Add. |                | Latit. |       | Incre-<br>ment<br>Add. |                | Latitude |       | Incre-<br>ment<br>Add. | Arg. L. |    |
|----------------|--------|-------|------------------------|----------------|--------|-------|------------------------|----------------|----------|-------|------------------------|---------|----|
|                | 0      | N. A. |                        |                | 1      | N. A. |                        |                | 2        | N. A. |                        |         |    |
|                | 6      | S. A. |                        |                | 7      | S. A. |                        |                | 8        | S. A. |                        |         |    |
|                | 0      | /     | 0                      | /              | 0      | /     | 0                      | /              | 0        | /     | 0                      | /       |    |
| 0              | 0      | 0     | 0                      | 0              | 2      | 29    | 39                     | 8              | 45       | 4     | 19                     | 22      | 30 |
| 1              | 0      | 5     | 14                     | 0              | 11     | 2     | 34                     | 9              | 9        | 1     | 4                      | 21      | 29 |
| 2              | 0      | 10    | 27                     | 0              | 22     | 2     | 38                     | 37             | 9        | 17    | 4                      | 24      | 28 |
| 3              | 0      | 15    | 40                     | 0              | 41     | 2     | 43                     | 1              | 9        | 33    | 4                      | 26      | 27 |
| 4              | 0      | 20    | 52                     | 1              | 0      | 2     | 47                     | 22             | 9        | 58    | 4                      | 29      | 26 |
| 5              | 0      | 26    | 4                      | 1              | 19     | 2     | 51                     | 41             | 10       | 4     | 4                      | 31      | 25 |
| 6              | 0      | 31    | 17                     | 1              | 38     | 2     | 55                     | 56             | 10       | 19    | 4                      | 33      | 24 |
| 7              | 0      | 36    | 28                     | 1              | 56     | 3     | 00                     | 8              | 10       | 34    | 4                      | 35      | 23 |
| 8              | 0      | 41    | 38                     | 2              | 15     | 3     | 4                      | 18             | 10       | 49    | 4                      | 37      | 22 |
| 9              | 0      | 46    | 48                     | 2              | 34     | 3     | 8                      | 23             | 11       | 4     | 4                      | 39      | 21 |
| 10             | 0      | 51    | 57                     | 2              | 53     | 3     | 12                     | 25             | 11       | 19    | 4                      | 41      | 20 |
| 11             | 0      | 57    | 5                      | 3              | 11     | 3     | 16                     | 24             | 11       | 33    | 4                      | 43      | 19 |
| 12             | 1      | 2     | 13                     | 3              | 30     | 3     | 20                     | 19             | 11       | 47    | 4                      | 44      | 18 |
| 13             | 1      | 7     | 18                     | 3              | 48     | 3     | 24                     | 11             | 12       | 1     | 4                      | 46      | 17 |
| 14             | 1      | 12    | 23                     | 4              | 6      | 3     | 27                     | 58             | 12       | 15    | 4                      | 47      | 16 |
| 15             | 1      | 17    | 27                     | 4              | 24     | 3     | 31                     | 42             | 12       | 29    | 4                      | 49      | 15 |
| 16             | 1      | 22    | 29                     | 4              | 42     | 3     | 35                     | 22             | 12       | 41    | 4                      | 50      | 14 |
| 17             | 1      | 27    | 29                     | 5              | 0      | 3     | 38                     | 58             | 12       | 54    | 4                      | 51      | 13 |
| 18             | 1      | 32    | 28                     | 5              | 18     | 3     | 42                     | 30             | 13       | 7     | 4                      | 53      | 12 |
| 19             | 1      | 37    | 26                     | 5              | 36     | 3     | 45                     | 58             | 13       | 20    | 4                      | 54      | 11 |
| 20             | 1      | 42    | 21                     | 5              | 54     | 3     | 49                     | 22             | 13       | 32    | 4                      | 55      | 10 |
| 21             | 1      | 47    | 14                     | 6              | 12     | 3     | 52                     | 42             | 13       | 44    | 4                      | 55      | 9  |
| 22             | 1      | 52    | 6                      | 6              | 30     | 3     | 55                     | 58             | 13       | 56    | 4                      | 56      | 8  |
| 23             | 1      | 56    | 56                     | 6              | 57     | 3     | 59                     | 9              | 14       | 8     | 4                      | 57      | 7  |
| 24             | 2      | 1     | 43                     | 7              | 4      | 4     | 2                      | 16             | 14       | 19    | 4                      | 57      | 6  |
| 25             | 2      | 6     | 28                     | 7              | 21     | 4     | 5                      | 18             | 14       | 30    | 4                      | 58      | 5  |
| 26             | 2      | 11    | 11                     | 7              | 38     | 4     | 8                      | 16             | 14       | 41    | 4                      | 58      | 4  |
| 27             | 2      | 15    | 52                     | 7              | 54     | 4     | 11                     | 9              | 14       | 51    | 4                      | 59      | 3  |
| 28             | 2      | 20    | 30                     | 8              | 11     | 4     | 13                     | 58             | 15       | 2     | 4                      | 59      | 2  |
| 29             | 2      | 25    | 7                      | 8              | 28     | 4     | 16                     | 42             | 15       | 11    | 4                      | 59      | 1  |
| 30             | 2      | 29    | 39                     | 8              | 45     | 4     | 19                     | 22             | 15       | 21    | 4                      | 59      | 0  |
| 5 N. } Descen. |        |       |                        | 4 N. } Descen. |        |       |                        | 3 N. } Descen. |          |       |                        |         |    |
| 11 S. }        |        |       |                        | 10 S. }        |        |       |                        | 9 S. }         |          |       |                        |         |    |

A Table of Reduction, with the Excess above the  
least Inclination  $4^{\circ} 59' 35''$ .

| Arg. L.      | Signs 6 |      | Exc. | Signs 7      |      | Exc. | Signs 8 |              | Exc. | Arg. L. |
|--------------|---------|------|------|--------------|------|------|---------|--------------|------|---------|
|              | Reduct. | sub. |      | Reduct.      | sub. |      | Reduct. | sub.         |      |         |
| 0            | 0       | 0    | 0    | 5            | 40   | 42   | 5       | 40           | 42   | 30      |
| 1            | 0       | 14   | 2    | 5            | 47   | 43   | 5       | 33           | 41   | 29      |
| 2            | 0       | 27   | 4    | 5            | 53   | 44   | 5       | 25           | 40   | 28      |
| 3            | 0       | 41   | 6    | 5            | 59   | 45   | 5       | 17           | 39   | 27      |
| 4            | 0       | 55   | 8    | 6            | 4    | 46   | 5       | 10           | 38   | 26      |
| 5            | 1       | 8    | 9    | 6            | 8    | 46   | 5       | 1            | 37   | 25      |
| 6            | 1       | 22   | 11   | 6            | 13   | 46   | 4       | 52           | 36   | 24      |
| 7            | 1       | 35   | 12   | 6            | 17   | 47   | 4       | 42           | 35   | 23      |
| 8            | 1       | 48   | 13   | 6            | 20   | 47   | 4       | 33           | 34   | 22      |
| 9            | 2       | 1    | 15   | 6            | 23   | 47   | 4       | 23           | 33   | 21      |
| 10           | 2       | 14   | 17   | 6            | 26   | 47   | 4       | 13           | 31   | 20      |
| 11           | 2       | 27   | 19   | 6            | 28   | 47   | 4       | 2            | 30   | 19      |
| 12           | 2       | 40   | 20   | 6            | 30   | 48   | 3       | 51           | 29   | 18      |
| 13           | 2       | 52   | 22   | 6            | 31   | 48   | 3       | 40           | 28   | 17      |
| 14           | 3       | 4    | 23   | 6            | 32   | 48   | 3       | 29           | 26   | 16      |
| 15           | 3       | 16   | 24   | 6            | 32   | 48   | 3       | 17           | 24   | 15      |
| 16           | 3       | 28   | 26   | 6            | 32   | 48   | 3       | 5            | 23   | 14      |
| 17           | 3       | 40   | 28   | 6            | 31   | 48   | 2       | 53           | 22   | 13      |
| 18           | 3       | 51   | 29   | 6            | 30   | 48   | 2       | 40           | 20   | 12      |
| 19           | 4       | 2    | 30   | 6            | 29   | 47   | 2       | 28           | 19   | 11      |
| 20           | 4       | 12   | 31   | 6            | 26   | 47   | 2       | 15           | 17   | 10      |
| 21           | 4       | 23   | 33   | 6            | 23   | 47   | 2       | 2            | 15   | 9       |
| 22           | 4       | 33   | 34   | 6            | 20   | 47   | 1       | 49           | 13   | 8       |
| 23           | 4       | 44   | 35   | 6            | 17   | 47   | 1       | 35           | 12   | 7       |
| 24           | 4       | 52   | 36   | 6            | 12   | 46   | 1       | 22           | 11   | 6       |
| 25           | 5       | 1    | 37   | 6            | 8    | 46   | 1       | 8            | 9    | 5       |
| 26           | 5       | 9    | 38   | 6            | 3    | 46   | 0       | 55           | 8    | 4       |
| 27           | 5       | 18   | 39   | 5            | 58   | 45   | 0       | 41           | 6    | 3       |
| 28           | 5       | 26   | 40   | 5            | 52   | 44   | 0       | 27           | 4    | 2       |
| 29           | 5       | 33   | 41   | 5            | 46   | 43   | 0       | 14           | 2    | 1       |
| 30           | 5       | 41   | 42   | 5            | 40   | 42   | 0       | 0            | 0    | 0       |
| Signs 5 Add. |         |      |      | Signs 4 Add. |      |      |         | Signs 3 Add. |      |         |



A Table of the Hourly Motions, Semi-diameters, and Horizontal Parallaxes of the Sun and Moon; the Sun's Horizontal Parallax being always 10".

| Mean Anom. of ☉ & ♃. |    | Hourly Motion ☉. |    | Hourly Motion ♃. |    | Mean Anom. of ☉ & ♃. |    |
|----------------------|----|------------------|----|------------------|----|----------------------|----|
| f.                   | o  | '                | "  | '                | "  | f.                   | o  |
| 0                    | 0  | 2                | 23 | 29               | 37 | 12                   | 0  |
| 0                    | 6  | 2                | 23 | 29               | 38 | 11                   | 24 |
| 0                    | 12 | 2                | 23 | 29               | 41 | 11                   | 18 |
| 0                    | 18 | 2                | 23 | 29               | 47 | 11                   | 12 |
| 0                    | 24 | 2                | 23 | 29               | 55 | 11                   | 6  |
| 1                    | 0  | 2                | 24 | 30               | 7  | 11                   | 0  |
| 1                    | 6  | 2                | 24 | 30               | 21 | 10                   | 24 |
| 1                    | 12 | 2                | 24 | 30               | 35 | 10                   | 18 |
| 1                    | 18 | 2                | 24 | 30               | 51 | 10                   | 12 |
| 1                    | 24 | 2                | 25 | 31               | 10 | 10                   | 6  |
| 2                    | 0  | 2                | 25 | 31               | 31 | 10                   | 0  |
| 2                    | 6  | 2                | 26 | 31               | 54 | 9                    | 24 |
| 2                    | 12 | 2                | 26 | 32               | 18 | 9                    | 18 |
| 2                    | 18 | 2                | 27 | 32               | 43 | 9                    | 12 |
| 2                    | 24 | 2                | 27 | 33               | 7  | 9                    | 6  |
| 3                    | 0  | 2                | 28 | 33               | 33 | 9                    | 0  |
| 3                    | 6  | 2                | 28 | 33               | 59 | 8                    | 24 |
| 3                    | 12 | 2                | 29 | 34               | 26 | 8                    | 18 |
| 3                    | 18 | 2                | 29 | 34               | 54 | 8                    | 12 |
| 3                    | 24 | 2                | 30 | 35               | 21 | 8                    | 6  |
| 4                    | 0  | 2                | 30 | 35               | 46 | 8                    | 0  |
| 4                    | 6  | 2                | 31 | 36               | 9  | 7                    | 24 |
| 4                    | 12 | 2                | 31 | 36               | 30 | 7                    | 18 |
| 4                    | 18 | 2                | 32 | 36               | 50 | 7                    | 12 |
| 4                    | 24 | 2                | 32 | 37               | 9  | 7                    | 6  |
| 5                    | 0  | 2                | 32 | 37               | 27 | 7                    | 0  |
| 5                    | 6  | 2                | 33 | 37               | 42 | 6                    | 24 |
| 5                    | 12 | 2                | 33 | 37               | 55 | 6                    | 18 |
| 5                    | 18 | 2                | 33 | 38               | 4  | 6                    | 12 |
| 5                    | 24 | 2                | 33 | 38               | 9  | 6                    | 6  |
| 6                    | 0  | 2                | 33 | 38               | 10 | 6                    | 0  |

A Table of the Hourly Motions, Semidiameters, and Horizontal Parallaxes of the Sun and Moon; the Sun's Horizontal Parallax being always  $10''$ : continued.

| Mean Anom. of ☉ & ☾. |    | Apparen. Semidia. ☉. | Apparen. Semidia. ☾. | Horizont. Parallax. ☾. | Mean Anom. of ☉ & ☾. |
|----------------------|----|----------------------|----------------------|------------------------|----------------------|
| f.                   | °  | '                    | "                    | '                      | "                    |
| 0                    | 0  | 15                   | 51                   | 14                     | 55                   |
| 0                    | 6  | 15                   | 51                   | 14                     | 55                   |
| 0                    | 12 | 15                   | 51                   | 14                     | 57                   |
| 0                    | 18 | 15                   | 51                   | 14                     | 58                   |
| 0                    | 24 | 15                   | 52                   | 15                     | 0                    |
| 1                    | 0  | 15                   | 53                   | 15                     | 3                    |
| 1                    | 6  | 15                   | 54                   | 15                     | 5                    |
| 1                    | 12 | 15                   | 55                   | 15                     | 8                    |
| 1                    | 18 | 15                   | 56                   | 15                     | 12                   |
| 1                    | 24 | 15                   | 57                   | 15                     | 15                   |
| 2                    | 0  | 15                   | 59                   | 15                     | 19                   |
| 2                    | 6  | 16                   | 0                    | 15                     | 23                   |
| 2                    | 12 | 16                   | 2                    | 15                     | 28                   |
| 2                    | 18 | 16                   | 3                    | 15                     | 33                   |
| 2                    | 24 | 16                   | 5                    | 15                     | 39                   |
| 3                    | 0  | 16                   | 7                    | 15                     | 45                   |
| 3                    | 6  | 16                   | 8                    | 15                     | 51                   |
| 3                    | 12 | 16                   | 10                   | 15                     | 56                   |
| 3                    | 18 | 16                   | 12                   | 16                     | 2                    |
| 3                    | 24 | 16                   | 14                   | 16                     | 6                    |
| 4                    | 0  | 16                   | 16                   | 16                     | 11                   |
| 4                    | 6  | 16                   | 18                   | 16                     | 15                   |
| 4                    | 12 | 16                   | 19                   | 16                     | 19                   |
| 4                    | 18 | 16                   | 20                   | 16                     | 23                   |
| 4                    | 24 | 16                   | 21                   | 16                     | 26                   |
| 5                    | 0  | 16                   | 21                   | 16                     | 29                   |
| 5                    | 6  | 16                   | 22                   | 16                     | 32                   |
| 5                    | 12 | 16                   | 23                   | 16                     | 34                   |
| 5                    | 18 | 16                   | 23                   | 16                     | 36                   |
| 5                    | 24 | 16                   | 24                   | 16                     | 38                   |
| 6                    | 0  | 16                   | 24                   | 16                     | 40                   |
| 0                    | 0  | 15                   | 51                   | 14                     | 55                   |
| 0                    | 6  | 15                   | 51                   | 14                     | 55                   |
| 0                    | 12 | 15                   | 51                   | 14                     | 57                   |
| 0                    | 18 | 15                   | 51                   | 14                     | 58                   |
| 0                    | 24 | 15                   | 52                   | 15                     | 0                    |
| 1                    | 0  | 15                   | 53                   | 15                     | 3                    |
| 1                    | 6  | 15                   | 54                   | 15                     | 5                    |
| 1                    | 12 | 15                   | 55                   | 15                     | 8                    |
| 1                    | 18 | 15                   | 56                   | 15                     | 12                   |
| 1                    | 24 | 15                   | 57                   | 15                     | 15                   |
| 2                    | 0  | 15                   | 59                   | 15                     | 19                   |
| 2                    | 6  | 16                   | 0                    | 15                     | 23                   |
| 2                    | 12 | 16                   | 2                    | 15                     | 28                   |
| 2                    | 18 | 16                   | 3                    | 15                     | 33                   |
| 2                    | 24 | 16                   | 5                    | 15                     | 39                   |
| 3                    | 0  | 16                   | 7                    | 15                     | 45                   |
| 3                    | 6  | 16                   | 8                    | 15                     | 51                   |
| 3                    | 12 | 16                   | 10                   | 15                     | 56                   |
| 3                    | 18 | 16                   | 12                   | 16                     | 2                    |
| 3                    | 24 | 16                   | 14                   | 16                     | 6                    |
| 4                    | 0  | 16                   | 16                   | 16                     | 11                   |
| 4                    | 6  | 16                   | 18                   | 16                     | 15                   |
| 4                    | 12 | 16                   | 19                   | 16                     | 19                   |
| 4                    | 18 | 16                   | 20                   | 16                     | 23                   |
| 4                    | 24 | 16                   | 21                   | 16                     | 26                   |
| 5                    | 0  | 16                   | 21                   | 16                     | 29                   |
| 5                    | 6  | 16                   | 22                   | 16                     | 32                   |
| 5                    | 12 | 16                   | 23                   | 16                     | 34                   |
| 5                    | 18 | 16                   | 23                   | 16                     | 36                   |
| 5                    | 24 | 16                   | 24                   | 16                     | 38                   |
| 6                    | 0  | 16                   | 24                   | 16                     | 40                   |

72 A Table of the Motion of the first Satellite of *Jupiter*.

| Years<br>Cur-<br>rent- | Motion.     | Years<br>Com. | Motion.     | Days. | Motion.     |
|------------------------|-------------|---------------|-------------|-------|-------------|
|                        | f. o ' "    |               | f. o ' "    |       | f. o ' "    |
| 1681                   | 10 8 50 5   | 1             | 2 23 6 50   | 1     | 6 23 24 21  |
| 1701                   | 3 18 8 28   | 2             | 5 16 13 40  | 2     | 1 16 48 42  |
| 1721                   | 8 27 26 50  | 3             | 8 9 20 30   | 3     | 8 10 13 2   |
| 1722                   | 11 20 33 40 | 4             | 5 25 51 40  | 4     | 3 3 37 23   |
| 1723                   | 2 13 40 30  | 5             | 8 18 38 30  | 5     | 9 27 1 44   |
| 1724                   | 5 6 47 20   | 6             | 11 12 5 20  | 6     | 4 20 26 5   |
| 1725                   | 2 23 18 51  | 7             | 2 5 12 10   | 7     | 11 13 50 26 |
| 1726                   | 5 16 25 21  | 8             | 11 21 43 21 | 8     | 6 7 14 47   |
| 1727                   | 8 9 32 11   | 9             | 2 14 50 11  | 9     | 1 0 39 7    |
| 1728                   | 11 2 39 1   | 10            | 5 7 57 1    | 10    | 7 24 3 28   |
| 1729                   | 8 19 10 12  | 11            | 8 1 3 51    | 11    | 2 17 27 49  |
| 1730                   | 11 2 17 2   | 12            | 5 17 35 1   | 12    | 9 10 52 10  |
| 1731                   | 1 25 23 52  | 13            | 8 10 41 51  | 13    | 4 4 16 30   |
| 1732                   | 4 18 30 41  | 14            | 11 3 48 41  | 14    | 10 27 40 52 |
| 1733                   | 2 5 1 52    | 15            | 1 26 55 31  | 15    | 5 21 5 12   |
| 1734                   | 4 28 8 42   | 16            | 11 13 26 42 | 16    | 0 14 29 33  |
| 1735                   | 7 21 15 32  | 17            | 2 6 33 32   | 17    | 7 7 53 54   |
| 1736                   | 10 14 22 22 | 18            | 4 29 40 22  | 18    | 2 1 18 15   |
| 1737                   | 8 0 53 33   | 19            | 7 22 47 12  | 19    | 8 24 42 36  |
| 1738                   | 10 24 0 23  | 20            | 5 9 18 23   | 20    | 3 18 6 57   |
| 1739                   | 1 17 7 13   | 40            | 10 18 36 45 | 21    | 10 11 31 17 |
| 1740                   | 4 10 14 3   | 60            | 3 27 55 8   | 22    | 5 4 55 38   |
| 1741                   | 2 6 45 13   | 80            | 9 7 13 30   | 23    | 11 28 19 59 |
| 1742                   | 11 23 16 24 | 100           | 2 16 31 53  | 24    | 6 21 44 20  |
| 1743                   | 2 16 23 14  | 200           | 5 3 3 46    | 25    | 1 15 8 41   |
| 1744                   | 5 9 30 4    | 300           | 7 19 35 39  | 26    | 8 8 33 2    |
| 1745                   | 2 26 1 15   | 400           | 10 6 7 32   | 27    | 3 1 57 22   |
| Jan.                   | 0 0 0 0     | 500           | 0 22 39 25  | 28    | 9 25 21 43  |
| Feb.                   | 6 5 34 46   | 600           | 3 9 11 18   | 29    | 4 18 46 4   |
| Mar.                   | 4 0 56 30   | 700           | 5 25 43 12  | 30    | 11 12 10 25 |
| Apr.                   | 10 6 31 16  | 800           | 8 12 15 5   | 31    | 6 5 34 46   |
| May                    | 9 18 41 41  | 900           | 10 28 46 58 |       |             |
| June                   | 3 24 16 27  | 1000          | 1 15 18 51  |       |             |
| July                   | 3 6 26 52   | 2000          | 3 0 47 42   |       |             |
| Aug.                   | 9 12 1 39   | 3000          | 4 15 56 33  |       |             |
| Sept.                  | 3 17 36 25  | 4000          | 6 1 15 24   |       |             |
| Oct.                   | 2 29 46 50  | 5000          | 7 16 34 15  |       |             |
| Nov.                   | 9 5 21 36   | 6000          | 9 1 53 6    |       |             |
| Dec.                   | 8 17 32 1   | 7000          | 10 17 11 57 |       |             |



A Table of the Motion of the first Satellite of Jupiter. 33

| H. | Motion. |    |    |     | Motion. |    |    |     | Motion. |    |    |     | Motion. |    |   |     |
|----|---------|----|----|-----|---------|----|----|-----|---------|----|----|-----|---------|----|---|-----|
|    | f.      | o. | '  | ''' | f.      | o. | '  | ''' | f.      | o. | '  | ''' | f.      | o. | ' | ''' |
| 1  | 0       | 8  | 28 | 31  | 1       | 0  | 8  | 29  | 31      | 4  | 22 | 45  |         |    |   |     |
| 2  | 0       | 16 | 57 | 2   | 2       | 0  | 16 | 57  | 32      | 4  | 31 | 13  |         |    |   |     |
| 3  | 0       | 25 | 25 | 33  | 3       | 0  | 25 | 26  | 33      | 4  | 39 | 41  |         |    |   |     |
| 4  | 1       | 3  | 54 | 3   | 4       | 0  | 33 | 54  | 34      | 4  | 48 | 10  |         |    |   |     |
| 5  | 1       | 12 | 22 | 34  | 5       | 0  | 42 | 23  | 35      | 4  | 56 | 38  |         |    |   |     |
| 6  | 1       | 20 | 51 | 5   | 6       | 0  | 50 | 51  | 36      | 5  | 5  | 7   |         |    |   |     |
| 7  | 1       | 29 | 19 | 36  | 7       | 0  | 59 | 20  | 37      | 5  | 13 | 35  |         |    |   |     |
| 8  | 2       | 7  | 48 | 7   | 8       | 1  | 7  | 48  | 38      | 5  | 22 | 4   |         |    |   |     |
| 9  | 2       | 16 | 16 | 38  | 9       | 1  | 16 | 17  | 39      | 5  | 30 | 32  |         |    |   |     |
| 10 | 2       | 24 | 45 | 9   | 10      | 1  | 24 | 45  | 40      | 5  | 39 | 1   |         |    |   |     |
| 11 | 3       | 3  | 13 | 40  | 11      | 1  | 33 | 14  | 41      | 5  | 47 | 29  |         |    |   |     |
| 12 | 3       | 11 | 42 | 10  | 12      | 1  | 41 | 42  | 42      | 5  | 55 | 58  |         |    |   |     |
| 13 | 3       | 20 | 10 | 41  | 13      | 1  | 50 | 11  | 43      | 6  | 4  | 26  |         |    |   |     |
| 14 | 3       | 28 | 39 | 12  | 14      | 1  | 58 | 39  | 44      | 6  | 12 | 55  |         |    |   |     |
| 15 | 4       | 7  | 7  | 43  | 15      | 2  | 7  | 8   | 45      | 6  | 21 | 23  |         |    |   |     |
| 16 | 4       | 15 | 36 | 14  | 16      | 2  | 15 | 36  | 46      | 6  | 29 | 52  |         |    |   |     |
| 17 | 4       | 24 | 4  | 45  | 17      | 2  | 24 | 5   | 47      | 6  | 38 | 20  |         |    |   |     |
| 18 | 5       | 2  | 33 | 16  | 18      | 2  | 32 | 33  | 48      | 6  | 46 | 49  |         |    |   |     |
| 19 | 5       | 11 | 1  | 46  | 19      | 2  | 41 | 2   | 49      | 6  | 55 | 17  |         |    |   |     |
| 20 | 5       | 19 | 30 | 17  | 20      | 2  | 49 | 30  | 50      | 7  | 3  | 46  |         |    |   |     |
| 21 | 5       | 27 | 58 | 48  | 21      | 2  | 57 | 59  | 51      | 7  | 12 | 14  |         |    |   |     |
| 22 | 6       | 6  | 27 | 19  | 22      | 3  | 6  | 27  | 52      | 7  | 20 | 43  |         |    |   |     |
| 23 | 6       | 14 | 55 | 50  | 23      | 3  | 14 | 56  | 53      | 7  | 29 | 11  |         |    |   |     |
| 24 | 6       | 23 | 24 | 21  | 24      | 3  | 23 | 24  | 54      | 7  | 37 | 40  |         |    |   |     |
|    |         |    |    |     | 25      | 3  | 31 | 53  | 55      | 7  | 46 | 8   |         |    |   |     |
|    |         |    |    |     | 26      | 3  | 40 | 21  | 56      | 7  | 54 | 37  |         |    |   |     |
|    |         |    |    |     | 27      | 3  | 48 | 50  | 57      | 8  | 3  | 5   |         |    |   |     |
|    |         |    |    |     | 28      | 3  | 57 | 18  | 58      | 8  | 11 | 34  |         |    |   |     |
|    |         |    |    |     | 29      | 4  | 5  | 47  | 59      | 8  | 20 | 2   |         |    |   |     |
|    |         |    |    |     | 30      | 4  | 14 | 15  | 60      | 8  | 28 | 31  |         |    |   |     |

In Leap-Year, after *February*, add the Motion of a Day more to the rest. The Radix of this Satellite I have taken *December 31* at Noon 1683. *Jupiter's* Heliocentric Place was then  $5^{\circ} 13' 22'' 57''$ . And the Half-Gray in the Shadow is  $1^h 6'$ . Mor.  $9^{\circ} 19' 22''$ .

L

74 A Table of the Motion of the second Satellite of Jupiter.

| Years<br>Cur-<br>rent- | Motion.     | Years<br>Com. | Motion.     | Days. | Motion.    |
|------------------------|-------------|---------------|-------------|-------|------------|
|                        | f. ° ' "    |               | f. ° ' "    |       | f. ° ' "   |
| 1681                   | 3 7 35 50   | 1             | 8 11 24 51  | 1     | 3 11 17 30 |
| 1701                   | 7 22 20 10  | 2             | 4 22 49 41  | 2     | 6 22 34 59 |
| 1721                   | 0 7 4 30    | 3             | 1 4 14 31   | 3     | 10 3 52 29 |
| 1722                   | 8 18 29 20  | 4             | 0 26 56 51  | 4     | 1 15 9 58  |
| 1723                   | 4 29 54 11  | 5             | 9 8 21 41   | 5     | 4 26 27 28 |
| 1724                   | 1 11 19 2   | 6             | 5 19 46 32  | 6     | 8 7 44 57  |
| 1725                   | 1 4 1 22    | 7             | 2 1 11 22   | 7     | 11 19 2 27 |
| 1726                   | 9 15 26 12  | 8             | 1 23 53 43  | 8     | 3 0 19 56  |
| 1727                   | 5 26 51 3   | 9             | 10 5 18 33  | 9     | 6 11 37 26 |
| 1728                   | 2 8 15 54   | 10            | 6 16 43 23  | 10    | 9 22 54 56 |
| 1729                   | 2 0 58 14   | 11            | 2 28 8 14   | 11    | 1 4 12 25  |
| 1730                   | 10 12 23 4  | 12            | 2 20 50 34  | 12    | 4 15 29 55 |
| 1731                   | 6 23 47 55  | 13            | 11 2 15 25  | 13    | 7 26 47 24 |
| 1732                   | 3 5 12 46   | 14            | 7 13 40 46  | 14    | 11 8 4 54  |
| 1733                   | 2 27 55 6   | 15            | 3 25 5 6    | 15    | 2 19 22 23 |
| 1734                   | 11 9 19 56  | 16            | 3 17 47 27  | 16    | 6 0 39 53  |
| 1735                   | 7 20 44 47  | 17            | 11 29 12 17 | 17    | 9 11 57 23 |
| 1736                   | 4 2 9 37    | 18            | 8 10 37 8   | 18    | 0 23 14 52 |
| 1737                   | 3 24 51 58  | 19            | 4 22 1 59   | 19    | 4 4 32 22  |
| 1738                   | 0 6 16 48   | 20            | 4 14 44 20  | 20    | 7 15 49 51 |
| 1739                   | 8 17 41 39  | 40            | 8 29 28 40  | 21    | 10 27 7 21 |
| 1740                   | 4 29 6 29   | 60            | 1 14 13 0   | 22    | 2 8 24 50  |
| 1741                   | 4 21 48 50  | 80            | 5 28 57 20  | 23    | 5 19 42 20 |
| 1742                   | 1 3 13 40   | 100           | 10 13 41 39 | 24    | 9 0 59 50  |
| 1743                   | 9 14 38 31  | 200           | 8 27 23 19  | 25    | 0 12 17 19 |
| 1744                   | 5 26 3 21   | 300           | 7 11 4 58   | 26    | 3 23 34 49 |
| 1745                   | 5 18 45 42  | 400           | 5 24 46 38  | 27    | 7 4 52 18  |
| Jan.                   | 0 0 0 0     | 500           | 4 8 28 17   | 28    | 10 16 9 48 |
| Feb.                   | 8 20 2 16   | 600           | 2 22 9 56   | 29    | 1 27 27 17 |
| Mar.                   | 7 6 12 4    | 700           | 1 5 31 36   | 30    | 5 8 44 47  |
| Apr.                   | 3 26 14 20  | 800           | 11 19 33 15 | 31    | 8 20 2 16  |
| May                    | 9 4 29 7    | 900           | 10 3 14 45  |       |            |
| June                   | 5 25 1 23   | 1000          | 8 16 56 24  |       |            |
| July                   | 11 3 46 10  | 2000          | 5 3 52 48   |       |            |
| Aug.                   | 7 23 48 26  | 3000          | 1 20 49 12  |       |            |
| Sept.                  | 4 13 50 42  | 4000          | 10 7 45 36  |       |            |
| Oct.                   | 9 22 35 29  | 5000          | 6 24 42 0   |       |            |
| Nov.                   | 6 12 37 45  | 6000          | 3 11 38 24  |       |            |
| Dec.                   | 11 21 22 34 | 7000          | 11 28 34 48 |       |            |

A Table of the Motion of the Second Satellite of *Jupiter*. 75

| H  | Motion. |    |    |    | /   | o | /   | "   | /   | o | /   | "   |
|----|---------|----|----|----|-----|---|-----|-----|-----|---|-----|-----|
|    | f.      | o  | /  | "  | /// | " | /// | /// | /// | " | /// | /// |
| 1  | 0       | 4  | 13 | 14 | 1   | 0 | 4   | 13  | 31  | 2 | 10  | 50  |
| 2  | 0       | 8  | 26 | 27 | 2   | 0 | 8   | 26  | 32  | 2 | 15  | 3   |
| 3  | 0       | 12 | 39 | 41 | 3   | 0 | 12  | 40  | 33  | 2 | 19  | 17  |
| 4  | 0       | 16 | 52 | 55 | 4   | 0 | 16  | 53  | 34  | 2 | 23  | 30  |
| 5  | 0       | 21 | 6  | 9  | 5   | 0 | 21  | 6   | 35  | 2 | 27  | 43  |
| 6  | 0       | 25 | 19 | 22 | 6   | 0 | 25  | 19  | 36  | 2 | 31  | 56  |
| 7  | 0       | 29 | 32 | 36 | 7   | 0 | 29  | 33  | 37  | 2 | 36  | 10  |
| 8  | 1       | 3  | 45 | 50 | 8   | 0 | 33  | 46  | 38  | 2 | 40  | 23  |
| 9  | 1       | 7  | 59 | 3  | 9   | 0 | 37  | 59  | 39  | 2 | 44  | 36  |
| 10 | 1       | 12 | 12 | 17 | 10  | 0 | 42  | 12  | 40  | 2 | 48  | 49  |
| 11 | 1       | 16 | 25 | 31 | 11  | 0 | 46  | 26  | 41  | 2 | 53  | 3   |
| 12 | 1       | 20 | 38 | 45 | 12  | 0 | 50  | 39  | 42  | 2 | 57  | 16  |
| 13 | 1       | 24 | 51 | 58 | 13  | 0 | 54  | 52  | 43  | 3 | 1   | 29  |
| 14 | 1       | 29 | 5  | 12 | 14  | 0 | 59  | 5   | 44  | 3 | 5   | 42  |
| 15 | 2       | 3  | 18 | 26 | 15  | 1 | 3   | 18  | 45  | 3 | 9   | 55  |
| 16 | 2       | 7  | 31 | 39 | 16  | 1 | 7   | 32  | 46  | 3 | 14  | 9   |
| 17 | 2       | 11 | 44 | 53 | 17  | 1 | 11  | 45  | 47  | 3 | 18  | 22  |
| 18 | 2       | 15 | 58 | 7  | 18  | 1 | 15  | 58  | 48  | 3 | 22  | 35  |
| 19 | 2       | 20 | 11 | 21 | 19  | 1 | 20  | 11  | 49  | 3 | 26  | 48  |
| 20 | 2       | 24 | 24 | 34 | 20  | 1 | 24  | 25  | 50  | 3 | 31  | 2   |
| 21 | 2       | 28 | 37 | 48 | 21  | 1 | 28  | 38  | 51  | 3 | 35  | 15  |
| 22 | 3       | 2  | 51 | 2  | 22  | 1 | 32  | 51  | 52  | 3 | 39  | 28  |
| 23 | 3       | 7  | 4  | 15 | 23  | 1 | 37  | 4   | 53  | 3 | 43  | 41  |
| 24 | 3       | 11 | 17 | 30 | 24  | 1 | 41  | 18  | 54  | 3 | 47  | 55  |
|    |         |    |    |    | 25  | 1 | 45  | 31  | 55  | 3 | 52  | 8   |
|    |         |    |    |    | 26  | 1 | 49  | 44  | 56  | 3 | 56  | 21  |
|    |         |    |    |    | 27  | 1 | 53  | 57  | 57  | 4 | 0   | 34  |
|    |         |    |    |    | 28  | 1 | 58  | 11  | 58  | 4 | 4   | 48  |
|    |         |    |    |    | 29  | 2 | 2   | 24  | 59  | 4 | 9   | 1   |
|    |         |    |    |    | 30  | 2 | 6   | 37  | 60  | 4 | 13  | 14  |

In Leap-Year, after *February*, add the Motion of a Day more to the rest. And the Radix of this Satellite I have taken *December 31* at Noon, 1683. *Jupiter's* Heliocentric Place was then  $5^{\circ} 13' 22'' 57''$ . Its Half-Stay in the Shadow is  $1^{\text{h}} 25'$  Mor.  $5^{\circ} 58' 45''$ .



76 A Table of the Motion of the third Satellite of Jupiter.

| Years<br>Cur-<br>rent. | Motion. |    |    |    | Years<br>Com. | Motion. |    |    |    | Days. | Motion. |    |    |    |
|------------------------|---------|----|----|----|---------------|---------|----|----|----|-------|---------|----|----|----|
|                        | f.      | o  | '  | "  |               | f.      | o  | '  | "  |       | f.      | o  | '  | "  |
| 1681                   | 2       | 22 | 15 | 57 | 1             | 11      | 5  | 35 | 40 | 1     | 1       | 20 | 14 | 4  |
| 1701                   | 6       | 25 | 19 | 36 | 2             | 10      | 11 | 11 | 19 | 2     | 3       | 10 | 28 | 8  |
| 1721                   | 10      | 28 | 23 | 14 | 3             | 9       | 16 | 46 | 59 | 3     | 5       | 0  | 42 | 13 |
| 1722                   | 10      | 3  | 58 | 53 | 4             | 10      | 12 | 36 | 44 | 4     | 6       | 20 | 56 | 17 |
| 1723                   | 9       | 9  | 34 | 33 | 5             | 9       | 18 | 12 | 23 | 5     | 8       | 11 | 10 | 21 |
| 1724                   | 8       | 15 | 10 | 13 | 6             | 8       | 23 | 48 | 3  | 6     | 10      | 1  | 24 | 25 |
| 1725                   | 9       | 10 | 59 | 57 | 7             | 7       | 29 | 23 | 42 | 7     | 11      | 21 | 38 | 30 |
| 1726                   | 8       | 16 | 35 | 37 | 8             | 8       | 25 | 13 | 27 | 8     | 1       | 11 | 52 | 34 |
| 1727                   | 7       | 22 | 11 | 17 | 9             | 8       | 0  | 49 | 7  | 9     | 3       | 2  | 6  | 38 |
| 1728                   | 6       | 27 | 46 | 57 | 10            | 7       | 6  | 24 | 46 | 10    | 4       | 22 | 20 | 42 |
| 1729                   | 7       | 23 | 36 | 41 | 11            | 6       | 12 | 0  | 26 | 11    | 6       | 12 | 34 | 46 |
| 1730                   | 6       | 29 | 12 | 21 | 12            | 7       | 7  | 50 | 11 | 12    | 8       | 2  | 48 | 51 |
| 1731                   | 6       | 4  | 48 | 1  | 13            | 6       | 13 | 25 | 50 | 13    | 9       | 23 | 2  | 55 |
| 1732                   | 5       | 10 | 23 | 40 | 14            | 5       | 19 | 1  | 30 | 14    | 11      | 13 | 16 | 59 |
| 1733                   | 6       | 6  | 13 | 24 | 15            | 4       | 24 | 37 | 9  | 15    | 1       | 3  | 31 | 3  |
| 1734                   | 5       | 11 | 49 | 4  | 16            | 5       | 20 | 26 | 54 | 16    | 2       | 23 | 45 | 7  |
| 1735                   | 4       | 17 | 24 | 44 | 17            | 4       | 26 | 2  | 34 | 17    | 4       | 13 | 59 | 12 |
| 1736                   | 3       | 23 | 0  | 24 | 18            | 4       | 1  | 38 | 14 | 18    | 6       | 4  | 13 | 16 |
| 1737                   | 4       | 18 | 50 | 8  | 19            | 3       | 7  | 13 | 53 | 19    | 7       | 24 | 27 | 20 |
| 1738                   | 3       | 24 | 25 | 48 | 20            | 4       | 3  | 3  | 38 | 20    | 9       | 14 | 41 | 24 |
| 1739                   | 3       | 0  | 1  | 28 | 40            | 8       | 6  | 7  | 16 | 21    | 11      | 4  | 55 | 29 |
| 1740                   | 2       | 5  | 37 | 8  | 60            | 0       | 9  | 10 | 54 | 22    | 0       | 25 | 9  | 33 |
| 1741                   | 3       | 1  | 26 | 52 | 80            | 4       | 12 | 14 | 32 | 23    | 2       | 15 | 23 | 37 |
| 1742                   | 2       | 7  | 2  | 32 | 100           | 8       | 15 | 18 | 10 | 24    | 4       | 5  | 37 | 41 |
| 1743                   | 1       | 12 | 38 | 11 | 200           | 5       | 0  | 36 | 21 | 25    | 5       | 25 | 51 | 45 |
| 1744                   | 0       | 18 | 13 | 51 | 300           | 1       | 15 | 54 | 31 | 26    | 7       | 16 | 5  | 50 |
| 1745                   | 1       | 4  | 3  | 35 | 400           | 10      | 1  | 12 | 42 | 27    | 9       | 6  | 19 | 54 |
| Jan.                   | 0       | 0  | 0  | 0  | 500           | 6       | 16 | 30 | 52 | 28    | 10      | 26 | 33 | 58 |
| Feb.                   | 3       | 27 | 16 | 11 | 600           | 3       | 1  | 49 | 3  | 29    | 0       | 16 | 48 | 2  |
| Mar.                   | 2       | 23 | 50 | 9  | 700           | 11      | 17 | 7  | 13 | 30    | 2       | 7  | 2  | 7  |
| Apr.                   | 6       | 21 | 6  | 20 | 800           | 8       | 2  | 25 | 24 | 31    | 3       | 27 | 16 | 11 |
| May.                   | 8       | 28 | 8  | 26 | 900           | 4       | 17 | 43 | 34 |       |         |    |    |    |
| June                   | 0       | 25 | 24 | 37 | 1000          | 1       | 3  | 1  | 45 |       |         |    |    |    |
| July                   | 3       | 2  | 26 | 43 | 2000          | 2       | 6  | 3  | 30 |       |         |    |    |    |
| Aug.                   | 6       | 29 | 42 | 54 | 3000          | 3       | 9  | 5  | 15 |       |         |    |    |    |
| Sept.                  | 10      | 26 | 59 | 5  | 4000          | 4       | 12 | 7  | 0  |       |         |    |    |    |
| Oct.                   | 1       | 4  | 1  | 12 | 5000          | 5       | 15 | 8  | 45 |       |         |    |    |    |
| Nov.                   | 5       | 1  | 17 | 22 | 6000          | 6       | 18 | 10 | 30 |       |         |    |    |    |
| Dec.                   | 7       | 8  | 19 | 29 | 7000          | 7       | 21 | 12 | 15 |       |         |    |    |    |

A Table of the Motion of the third Satellite of *Jupiter*. 77

| H  | Motion. |    |    |    |     |   |    |    |    |     |    |    |   |   |
|----|---------|----|----|----|-----|---|----|----|----|-----|----|----|---|---|
|    | s.      | o  | '  | "  | /// |   | o  | '  | "  | /// |    | o  | ' | " |
| 1  | 0       | 2  | 5  | 35 | 1   | 0 | 2  | 6  | 31 | 1   | 4  | 53 |   |   |
| 2  | 0       | 4  | 11 | 10 | 2   | 0 | 4  | 11 | 32 | 1   | 6  | 59 |   |   |
| 3  | 0       | 6  | 16 | 45 | 3   | 0 | 6  | 17 | 33 | 1   | 9  | 4  |   |   |
| 4  | 0       | 8  | 22 | 21 | 4   | 0 | 8  | 22 | 34 | 1   | 11 | 10 |   |   |
| 5  | 0       | 10 | 27 | 56 | 5   | 0 | 10 | 28 | 35 | 1   | 13 | 15 |   |   |
| 6  | 0       | 12 | 33 | 31 | 6   | 0 | 12 | 33 | 36 | 1   | 15 | 21 |   |   |
| 7  | 0       | 14 | 39 | 6  | 7   | 0 | 14 | 39 | 37 | 1   | 17 | 27 |   |   |
| 8  | 0       | 16 | 44 | 41 | 8   | 0 | 16 | 45 | 38 | 1   | 19 | 32 |   |   |
| 9  | 0       | 18 | 50 | 16 | 9   | 0 | 18 | 50 | 39 | 1   | 21 | 38 |   |   |
| 10 | 0       | 20 | 55 | 52 | 10  | 0 | 20 | 56 | 40 | 1   | 23 | 43 |   |   |
| 11 | 0       | 23 | 1  | 27 | 11  | 0 | 23 | 1  | 41 | 1   | 25 | 49 |   |   |
| 12 | 0       | 23 | 7  | 2  | 12  | 0 | 25 | 7  | 42 | 1   | 27 | 54 |   |   |
| 13 | 0       | 27 | 12 | 37 | 13  | 0 | 27 | 13 | 43 | 1   | 30 | 0  |   |   |
| 14 | 0       | 29 | 18 | 12 | 14  | 0 | 29 | 18 | 44 | 1   | 32 | 6  |   |   |
| 15 | 1       | 1  | 23 | 47 | 15  | 0 | 31 | 24 | 45 | 1   | 34 | 11 |   |   |
| 16 | 1       | 3  | 29 | 23 | 16  | 0 | 33 | 29 | 46 | 1   | 36 | 17 |   |   |
| 17 | 1       | 5  | 34 | 58 | 17  | 0 | 35 | 35 | 47 | 1   | 38 | 22 |   |   |
| 18 | 1       | 7  | 40 | 33 | 18  | 0 | 37 | 40 | 48 | 1   | 40 | 28 |   |   |
| 19 | 1       | 9  | 46 | 8  | 19  | 0 | 39 | 46 | 49 | 1   | 42 | 33 |   |   |
| 20 | 1       | 11 | 51 | 43 | 20  | 0 | 41 | 52 | 50 | 1   | 44 | 39 |   |   |
| 21 | 1       | 13 | 57 | 18 | 21  | 0 | 43 | 57 | 51 | 1   | 46 | 46 |   |   |
| 22 | 1       | 16 | 2  | 54 | 22  | 0 | 46 | 3  | 52 | 1   | 48 | 50 |   |   |
| 23 | 1       | 18 | 8  | 29 | 23  | 0 | 48 | 8  | 53 | 1   | 50 | 57 |   |   |
| 24 | 1       | 20 | 14 | 4  | 24  | 0 | 50 | 14 | 54 | 1   | 53 | 1  |   |   |
|    |         |    |    |    | 25  | 0 | 52 | 20 | 55 | 1   | 55 | 7  |   |   |
|    |         |    |    |    | 26  | 0 | 54 | 25 | 56 | 1   | 57 | 14 |   |   |
|    |         |    |    |    | 27  | 0 | 56 | 31 | 57 | 1   | 59 | 18 |   |   |
|    |         |    |    |    | 28  | 0 | 58 | 36 | 58 | 2   | 1  | 25 |   |   |
|    |         |    |    |    | 29  | 1 | 0  | 42 | 59 | 2   | 3  | 29 |   |   |
|    |         |    |    |    | 30  | 1 | 2  | 47 | 60 | 2   | 5  | 35 |   |   |

In Leap-Year, after *February*, add the Motion of a Day more to the rest. And the Radix of this Satellite I have taken *December 31* at Noon, 1683. *Jupiter's* Heliocentric Place was then  $5^{\circ} 13' 22'' 57''$ . Half-Stay in the Shadow  $1^{\text{h}} 18'$  Mor.  $2^{\circ} 43' 15''$ .

78 A Table of the Motion of the Fourth Satellite of Jupiter.

| Years<br>Cur-<br>rent | Motion.     | Years<br>Com. | Motion.     | Days. | Motion.     |
|-----------------------|-------------|---------------|-------------|-------|-------------|
|                       | f. ° ' "    |               | f. ° ' "    |       | f. ° ' "    |
| 1681                  | 8 12 56 51  | 1             | 9 13 5 7    | 1     | 0 21 29 16  |
| 1701                  | 8 22 5 31   | 2             | 6 26 10 14  | 2     | 1 12 58 33  |
| 1721                  | 9 1 14 10   | 3             | 4 9 15 21   | 3     | 2 4 27 49   |
| 1722                  | 6 14 19 17  | 4             | 2 13 49 44  | 4     | 2 25 57 6   |
| 1723                  | 3 27 24 24  | 5             | 11 26 54 51 | 5     | 3 17 26 22  |
| 1724                  | 1 10 29 31  | 6             | 9 9 59 58   | 6     | 4 8 55 39   |
| 1725                  | 11 15 3 54  | 7             | 6 23 5 4    | 7     | 5 0 24 55   |
| 1726                  | 8 28 9 1    | 8             | 4 27 39 28  | 8     | 5 21 54 12  |
| 1727                  | 6 11 14 8   | 9             | 2 10 44 35  | 9     | 6 13 23 28  |
| 1728                  | 3 24 19 14  | 10            | 11 23 49 41 | 10    | 7 4 52 45   |
| 1729                  | 1 28 53 38  | 11            | 9 6 54 48   | 11    | 7 26 22 1   |
| 1730                  | 11 11 58 45 | 12            | 7 11 29 12  | 12    | 8 17 51 18  |
| 1731                  | 8 25 3 51   | 13            | 4 24 34 18  | 13    | 9 9 20 34   |
| 1732                  | 6 8 8 58    | 14            | 2 7 39 25   | 14    | 10 0 49 51  |
| 1733                  | 4 12 43 32  | 15            | 11 20 44 32 | 15    | 10 22 19 7  |
| 1734                  | 1 25 48 28  | 16            | 9 25 18 15  | 16    | 11 13 48 23 |
| 1735                  | 11 8 53 35  | 17            | 7 8 24 2    | 17    | 0 5 17 40   |
| 1736                  | 8 21 58 42  | 18            | 4 21 29 9   | 18    | 0 26 46 56  |
| 1737                  | 6 26 33 5   | 19            | 2 4 34 16   | 19    | 1 18 16 13  |
| 1738                  | 4 9 38 12   | 20            | 0 9 8 39    | 20    | 2 9 45 29   |
| 1739                  | 1 22 43 19  | 40            | 0 18 17 19  | 21    | 3 1 14 46   |
| 1740                  | 11 5 48 26  | 60            | 0 27 25 58  | 22    | 3 22 44 2   |
| 1741                  | 9 10 22 50  | 80            | 1 6 34 38   | 23    | 4 14 13 19  |
| 1742                  | 6 23 27 56  | 100           | 1 15 43 17  | 24    | 5 5 42 35   |
| 1743                  | 4 6 23 3    | 200           | 3 1 26 35   | 25    | 5 27 11 52  |
| 1744                  | 1 19 38 10  | 300           | 4 17 9 52   | 26    | 6 18 41 8   |
| 1745                  | 11 24 12 34 | 400           | 6 2 53 9    | 27    | 7 10 10 25  |
| Jan.                  | 0 0 0 0     | 500           | 7 18 36 27  | 28    | 8 1 39 41   |
| Feb.                  | 10 6 7 30   | 600           | 9 4 19 44   | 29    | 8 23 8 58   |
| Mar.                  | 6 7 47 11   | 700           | 10 29 3 1   | 30    | 9 14 38 14  |
| Apr.                  | 4 13 54 41  | 800           | 0 5 46 19   | 31    | 10 6 7 30   |
| May                   | 1 28 32 55  | 900           | 1 21 29 36  |       |             |
| June                  | 0 4 40 26   | 1000          | 3 7 12 53   |       |             |
| July                  | 9 19 18 40  | 2000          | 6 14 25 46  |       |             |
| Aug.                  | 7 25 26 10  | 3000          | 9 21 38 39  |       |             |
| Sept.                 | 6 1 33 40   | 4000          | 0 28 51 31  |       |             |
| Oct.                  | 3 16 11 54  | 5000          | 4 6 4 25    |       |             |
| Nov.                  | 1 22 19 24  | 6000          | 7 13 17 18  |       |             |
| Dec.                  | 11 26 57 38 | 7000          | 10 20 30 11 |       |             |



A Table of the Motion of the fourth Satellite of *Jupiter*. 79

| H     | °  | '   | "   | H  | °  | '   | "   |
|-------|----|-----|-----|----|----|-----|-----|
| I     | I  | "   | ''' | I  | I  | "   | ''' |
| #     | II | ''' | ''' | #  | II | ''' | ''' |
| <hr/> |    |     |     |    |    |     |     |
| 1     | 0  | 53  | 43  | 31 | 25 | 45  | 19  |
| 2     | 1  | 47  | 26  | 32 | 28 | 39  | 2   |
| 3     | 2  | 41  | 10  | 33 | 29 | 32  | 45  |
| 4     | 3  | 34  | 53  | 34 | 30 | 26  | 28  |
| 5     | 4  | 28  | 36  | 35 | 31 | 20  | 11  |
| 6     | 5  | 22  | 19  | 36 | 32 | 13  | 55  |
| 7     | 6  | 16  | 2   | 37 | 33 | 7   | 38  |
| 8     | 7  | 9   | 45  | 38 | 34 | 1   | 21  |
| 9     | 8  | 3   | 29  | 39 | 34 | 55  | 4   |
| 10    | 8  | 57  | 12  | 40 | 35 | 48  | 47  |
| 11    | 9  | 50  | 55  | 41 | 36 | 42  | 31  |
| 12    | 10 | 44  | 38  | 42 | 37 | 36  | 14  |
| 13    | 11 | 38  | 21  | 43 | 38 | 29  | 57  |
| 14    | 12 | 32  | 5   | 44 | 39 | 23  | 40  |
| 15    | 13 | 25  | 48  | 45 | 40 | 17  | 23  |
| 16    | 14 | 19  | 31  | 46 | 41 | 11  | 6   |
| 17    | 15 | 13  | 14  | 47 | 42 | 4   | 50  |
| 18    | 16 | 6   | 57  | 48 | 42 | 58  | 33  |
| 19    | 17 | 0   | 40  | 49 | 43 | 52  | 16  |
| 20    | 17 | 54  | 24  | 50 | 44 | 45  | 59  |
| 21    | 18 | 48  | 7   | 51 | 45 | 39  | 42  |
| 22    | 19 | 41  | 50  | 52 | 46 | 33  | 26  |
| 23    | 20 | 35  | 33  | 53 | 47 | 27  | 9   |
| 24    | 21 | 29  | 16  | 54 | 48 | 20  | 52  |
| 25    | 22 | 23  | 0   | 55 | 49 | 14  | 35  |
| 26    | 23 | 16  | 43  | 56 | 50 | 8   | 18  |
| 27    | 24 | 10  | 26  | 57 | 51 | 2   | 1   |
| 28    | 25 | 4   | 9   | 58 | 51 | 55  | 45  |
| 29    | 25 | 57  | 32  | 59 | 52 | 49  | 28  |
| 30    | 26 | 51  | 35  | 60 | 53 | 43  | 11  |

In Leap-Year, after *February*, add the Motion of a Day more to the rest. And the Radix of this Satellite I have taken *December* 31 at Noon, 1683. *Jupiter's* Heliocentric Place was then  $5^{\circ} 13' 22'' 57''$ . Half-Stay in the Shadow  $1^{\text{h}} 35'$ . Mor.  $1^{\circ} 25' 3''$ .

**A Table of the Distances of the Satellites of *Jupiter* from his Body, in Semidiameters and Decimal Parts of *Jupiter*'s Globe.**

| Satellite 1.           |                        |                       |                       |    |
|------------------------|------------------------|-----------------------|-----------------------|----|
| °                      | 0 Conseq.<br>6 Antec.  | 1 Conseq.<br>7 Antec. | 2 Conseq.<br>8 Antec. | °  |
| 0                      | 0.                     | 1.8592                | 3.7183                | 30 |
| 3                      | 0.1859                 | 1.0451                | 3.9042                | 27 |
| 6                      | 0.3718                 | 2.2310                | 4.0901                | 24 |
| 9                      | 0.5577                 | 2.4169                | 4.2760                | 21 |
| 12                     | 0.7436                 | 2.6028                | 4.4619                | 18 |
| 15                     | 0.9300                 | 2.7887                | 4.6478                | 15 |
| 18                     | 1.1155                 | 2.9746                | 4.8337                | 12 |
| 21                     | 1.3014                 | 3.1606                | 5.0196                | 9  |
| 24                     | 1.4873                 | 3.3465                | 5.2056                | 6  |
| 27                     | 1.6732                 | 3.5324                | 5.3915                | 3  |
| 30                     | 1.8592                 | 3.7183                | 5.5780                | 0  |
| Satellite 2.           |                        |                       |                       |    |
| °                      | 0.                     | 2.9590                | 5.9180                | 30 |
| 3                      | 0.2959                 | 3.2549                | 6.2139                | 27 |
| 6                      | 0.5918                 | 3.5508                | 6.5098                | 24 |
| 9                      | 0.8877                 | 3.8467                | 6.8057                | 21 |
| 12                     | 1.1836                 | 4.1426                | 7.1016                | 18 |
| 15                     | 1.4795                 | 4.4385                | 7.3975                | 15 |
| 18                     | 1.7754                 | 4.7344                | 7.6934                | 12 |
| 21                     | 2.0713                 | 5.0303                | 7.9893                | 9  |
| 24                     | 2.3672                 | 5.3262                | 8.2852                | 6  |
| 27                     | 2.6631                 | 5.6221                | 8.5811                | 3  |
| 30                     | 2.9590                 | 5.9180                | 8.8760                | 0  |
| 3 Conseq.<br>11 Antec. | 4 Conseq.<br>10 Antec. | 3 Conseq.<br>9 Antec. |                       |    |

A Table of the Distances of the Satellites of *Jupiter* from his Body, in Semidiameters and Decimal Parts of *Jupiter's* Globe.

## Satellite 3.

| °  | 0 Conseq.<br>6 Antec. | 1 Conseq.<br>7 Antec. | 2 Conseq.<br>8 Antec. | °  |
|----|-----------------------|-----------------------|-----------------------|----|
| 0  | 0.                    | 4.72                  | 9.44                  | 30 |
| 3  | 0.472                 | 5.192                 | 9.912                 | 27 |
| 6  | 0.944                 | 5.664                 | 10.384                | 24 |
| 9  | 1.416                 | 6.136                 | 10.856                | 21 |
| 12 | 1.888                 | 6.608                 | 11.328                | 18 |
| 15 | 2.36                  | 7.08                  | 11.8                  | 15 |
| 18 | 2.832                 | 7.552                 | 12.272                | 12 |
| 21 | 3.304                 | 8.024                 | 12.744                | 9  |
| 24 | 3.776                 | 8.496                 | 13.216                | 6  |
| 27 | 4.248                 | 8.968                 | 13.688                | 3  |
| 30 | 4.72                  | 9.44                  | 14.159                | 0  |

## Satellite 4.

| °  | 0                      | 8.301                  | 16.602                | 30 |
|----|------------------------|------------------------|-----------------------|----|
| 3  | 0.8301                 | 9.1311                 | 17.4321               | 27 |
| 6  | 1.6602                 | 9.9612                 | 18.2622               | 24 |
| 9  | 2.4903                 | 10.7913                | 19.0923               | 21 |
| 12 | 3.3204                 | 11.6214                | 19.9224               | 18 |
| 15 | 4.1505                 | 12.4515                | 20.7525               | 15 |
| 18 | 4.9806                 | 13.2816                | 21.5826               | 12 |
| 21 | 5.8107                 | 14.1117                | 22.4127               | 9  |
| 24 | 6.6408                 | 14.9418                | 23.2428               | 6  |
| 27 | 7.4709                 | 15.7719                | 24.0729               | 3  |
| 30 | 8.301                  | 16.602                 | 24.903                | 0  |
|    | 5 Conseq.<br>11 Antec. | 4 Conseq.<br>10 Antec. | 3 Conseq.<br>9 Antec. |    |



82 A Table of the Motion of the first Satellite of Saturn.

| Years<br>Cur-<br>rent. | Motion.     | Years<br>Com. | Motion.     | Days. | Motion.     |
|------------------------|-------------|---------------|-------------|-------|-------------|
|                        | f. o ' "    |               | f. o ' "    |       | f. o ' "    |
| 1681                   | 9 28 34 39  | 1             | 4 4 35 1    | 1     | 6 10 41 51  |
| 1701                   | 4 23 43 6   | 2             | 8 9 10 1    | 2     | 0 21 23 42  |
| 1721                   | 11 18 52 53 | 3             | 0 13 45 2   | 3     | 7 2 5 33    |
| 1722                   | 3 23 27 34  | 4             | 10 29 1 53  | 4     | 1 12 47 24  |
| 1723                   | 7 28 2 34   | 5             | 3 3 36 54   | 5     | 7 23 29 15  |
| 1724                   | 0 2 37 35   | 6             | 7 8 11 55   | 6     | 2 4 11 6    |
| 1725                   | 19 17 54 27 | 7             | 11 12 46 55 | 7     | 8 14 52 57  |
| 1726                   | 2 22 29 27  | 8             | 9 28 3 47   | 8     | 2 25 34 48  |
| 1727                   | 6 27 4 28   | 9             | 2 2 38 47   | 9     | 9 6 16 39   |
| 1728                   | 11 1 39 28  | 10            | 6 7 13 48   | 10    | 3 16 58 29  |
| 1729                   | 9 16 56 20  | 11            | 10 11 48 49 | 11    | 9 27 40 20  |
| 1730                   | 1 21 31 21  | 12            | 8 27 5 40   | 12    | 4 8 22 11   |
| 1731                   | 5 26 6 21   | 13            | 1 1 40 41   | 13    | 10 19 4 2   |
| 1732                   | 10 0 41 22  | 14            | 5 6 15 41   | 14    | 4 29 45 53  |
| 1733                   | 8 15 58 13  | 15            | 9 10 50 42  | 15    | 11 10 27 44 |
| 1734                   | 0 20 33 14  | 16            | 7 26 7 34   | 16    | 5 21 9 35   |
| 1735                   | 4 25 8 15   | 17            | 0 0 42 34   | 17    | 0 1 51 26   |
| 1736                   | 8 29 43 15  | 18            | 4 5 17 35   | 18    | 6 12 33 17  |
| 1737                   | 7 15 0 7    | 19            | 8 9 52 35   | 19    | 0 23 15 8   |
| 1738                   | 11 19 35 7  | 20            | 6 25 9 27   | 20    | 7 3 56 59   |
| 1739                   | 3 24 10 8   | 40            | 1 20 18 55  | 21    | 1 14 38 50  |
| 1740                   | 7 28 45 9   | 60            | 8 15 28 22  | 22    | 7 25 20 41  |
| 1741                   | 6 14 2 0    | 80            | 3 10 37 50  | 23    | 2 6 2 32    |
| 1742                   | 10 18 37 1  | 100           | 10 5 47 17  | 24    | 8 16 44 23  |
| 1743                   | 2 23 12 1   | 200           | 8 11 34 34  | 25    | 2 27 16 14  |
| 1744                   | 6 27 47 2   | 300           | 6 17 21 51  | 26    | 9 8 8 5     |
| 1745                   | 5 13 3 53   | 400           | 4 23 9 8    | 27    | 3 18 49 56  |
| Jan.                   | 0 0 0 0     | 500           | 2 28 56 25  | 28    | 9 29 31 47  |
| Feb.                   | 5 1 37 19   | 600           | 1 4 43 42   | 29    | 4 10 13 38  |
| Mar.                   | 3 1 9 6     | 700           | 11 10 30 59 | 30    | 10 20 55 28 |
| Apr.                   | 8 2 46 26   | 800           | 9 16 18 16  | 31    | 5 1 37 19   |
| May                    | 6 23 41 55  | 900           | 7 22 5 33   |       |             |
| June                   | 11 25 19 14 | 1000          | 5 27 52 50  |       |             |
| July                   | 10 16 14 53 | 2000          | 11 25 45 40 |       |             |
| Aug.                   | 3 17 52 13  | 3000          | 5 23 38 30  |       |             |
| Sept.                  | 8 19 29 32  | 4000          | 11 21 31 20 |       |             |
| Oct.                   | 7 10 24 51  | 5000          | 5 19 24 10  |       |             |
| Nov.                   | 0 12 2 11   | 6000          | 11 17 17 0  |       |             |
| Dec.                   | 11 2 57 39  | 7000          | 5 15 9 50   |       |             |

A Table of the Motion of the first Satellite of Saturn. 23

| H. | Motion. |    |    |    | /   | o | '   | "   | /   | o | '   | "   |
|----|---------|----|----|----|-----|---|-----|-----|-----|---|-----|-----|
|    | f       | o  | '  | "  | /// | " | /// | /// | /// | " | /// | /// |
| 1  | 0       | 7  | 56 | 41 | 1   | 0 | 7   | 57  | 31  | 4 | 6   | 19  |
| 2  | 0       | 15 | 53 | 29 | 2   | 0 | 15  | 53  | 32  | 4 | 14  | 15  |
| 3  | 0       | 23 | 50 | 14 | 3   | 0 | 23  | 50  | 33  | 4 | 22  | 12  |
| 4  | 1       | 1  | 46 | 58 | 4   | 0 | 31  | 47  | 34  | 4 | 30  | 9   |
| 5  | 1       | 9  | 43 | 43 | 5   | 0 | 39  | 44  | 35  | 4 | 38  | 6   |
| 6  | 1       | 17 | 40 | 28 | 6   | 0 | 47  | 40  | 36  | 4 | 46  | 12  |
| 7  | 1       | 25 | 37 | 12 | 7   | 0 | 55  | 37  | 37  | 4 | 53  | 59  |
| 8  | 2       | 3  | 33 | 57 | 8   | 1 | 3   | 34  | 38  | 5 | 1   | 50  |
| 9  | 2       | 11 | 30 | 42 | 9   | 1 | 11  | 31  | 39  | 5 | 9   | 53  |
| 10 | 2       | 19 | 27 | 26 | 10  | 1 | 19  | 27  | 40  | 5 | 17  | 49  |
| 11 | 2       | 27 | 24 | 11 | 11  | 1 | 27  | 24  | 41  | 5 | 25  | 46  |
| 12 | 3       | 5  | 20 | 55 | 12  | 1 | 35  | 21  | 42  | 5 | 33  | 43  |
| 13 | 3       | 13 | 17 | 40 | 13  | 1 | 43  | 18  | 43  | 5 | 41  | 40  |
| 14 | 3       | 21 | 14 | 25 | 14  | 1 | 51  | 14  | 44  | 5 | 49  | 36  |
| 15 | 3       | 29 | 11 | 9  | 15  | 1 | 59  | 11  | 45  | 5 | 57  | 33  |
| 16 | 4       | 7  | 7  | 54 | 16  | 2 | 7   | 8   | 46  | 6 | 5   | 30  |
| 17 | 4       | 15 | 4  | 38 | 17  | 2 | 15  | 4   | 47  | 6 | 13  | 26  |
| 18 | 4       | 23 | 1  | 23 | 18  | 2 | 23  | 1   | 48  | 6 | 21  | 23  |
| 19 | 5       | 0  | 58 | 8  | 19  | 2 | 30  | 58  | 49  | 6 | 29  | 20  |
| 20 | 5       | 8  | 54 | 52 | 20  | 2 | 38  | 55  | 50  | 6 | 37  | 17  |
| 21 | 5       | 16 | 51 | 37 | 21  | 2 | 46  | 51  | 51  | 6 | 43  | 13  |
| 22 | 5       | 24 | 48 | 22 | 22  | 2 | 54  | 48  | 52  | 6 | 53  | 10  |
| 23 | 6       | 2  | 45 | 7  | 23  | 3 | 2   | 45  | 53  | 7 | 1   | 7   |
| 24 | 6       | 10 | 41 | 51 | 24  | 3 | 10  | 42  | 54  | 7 | 9   | 4   |
|    |         |    |    |    | 25  | 3 | 18  | 38  | 55  | 7 | 17  | 0   |
|    |         |    |    |    | 26  | 3 | 26  | 35  | 56  | 7 | 24  | 57  |
|    |         |    |    |    | 27  | 3 | 34  | 32  | 57  | 7 | 32  | 54  |
|    |         |    |    |    | 28  | 3 | 42  | 29  | 58  | 7 | 40  | 51  |
|    |         |    |    |    | 29  | 3 | 50  | 25  | 59  | 7 | 48  | 57  |
|    |         |    |    |    | 30  | 3 | 58  | 22  | 60  | 7 | 56  | 45  |

In Leap-Year, after February, add the Motion of a Day more to the rest.

Its Nodes are in  $\text{MR} \times 21^\circ$ . Inclination  $31^\circ$ .

The Epoche of this Satellite I have taken, Anno 1713, December 31 at Noon,  $\text{h}$  Geocentric Place was then  $5^\circ 11' 6'' 9''$ .

84 A Table of the Motion of the Second Satellite of Saturn.

| Years<br>Cur-<br>rent. | Motion.   |          |          |          | Years<br>Com. | Motion.   |          |          |          | Days. | Motion.   |          |          |          |
|------------------------|-----------|----------|----------|----------|---------------|-----------|----------|----------|----------|-------|-----------|----------|----------|----------|
|                        | <i>f.</i> | <i>o</i> | <i>i</i> | <i>"</i> |               | <i>f.</i> | <i>o</i> | <i>i</i> | <i>"</i> |       | <i>f.</i> | <i>o</i> | <i>i</i> | <i>"</i> |
| 1681                   | 11        | 5        | 28       | 41       | 1             | 4         | 10       | 2        | 32       | 1     | 4         | 11       | 32       | 4        |
| 1701                   | 11        | 24       | 6        | 19       | 2             | 8         | 20       | 5        | 44       | 2     | 8         | 23       | 4        | 7        |
| 1721                   | 0         | 12       | 43       | 57       | 3             | 1         | 0        | 8        | 36       | 3     | 1         | 4        | 36       | 11       |
| 1722                   | 4         | 22       | 46       | 49       | 4             | 9         | 21       | 43       | 32       | 4     | 5         | 16       | 8        | 15       |
| 1723                   | 9         | 2        | 49       | 41       | 5             | 2         | 1        | 46       | 23       | 5     | 9         | 27       | 40       | 19       |
| 1724                   | 1         | 12       | 52       | 33       | 6             | 6         | 11       | 49       | 15       | 6     | 2         | 9        | 12       | 22       |
| 1725                   | 10        | 4        | 27       | 29       | 7             | 10        | 21       | 52       | 7        | 7     | 6         | 20       | 44       | 26       |
| 1726                   | 2         | 14       | 30       | 21       | 8             | 7         | 13       | 27       | 3        | 8     | 11        | 2        | 16       | 30       |
| 1727                   | 6         | 24       | 33       | 13       | 9             | 11        | 23       | 29       | 55       | 9     | 3         | 13       | 48       | 34       |
| 1728                   | 11        | 4        | 36       | 5        | 10            | 4         | 3        | 32       | 47       | 10    | 7         | 25       | 20       | 37       |
| 1729                   | 7         | 26       | 11       | 0        | 11            | 8         | 13       | 39       | 39       | 11    | 0         | 6        | 52       | 41       |
| 1730                   | 0         | 6        | 13       | 52       | 12            | 5         | 5        | 10       | 35       | 12    | 4         | 18       | 24       | 45       |
| 1731                   | 4         | 16       | 16       | 44       | 13            | 9         | 15       | 13       | 27       | 13    | 8         | 29       | 56       | 49       |
| 1732                   | 8         | 26       | 19       | 36       | 14            | 1         | 25       | 16       | 19       | 14    | 1         | 11       | 28       | 52       |
| 1733                   | 5         | 17       | 54       | 32       | 15            | 6         | 5        | 19       | 10       | 15    | 5         | 23       | 0        | 56       |
| 1734                   | 9         | 27       | 57       | 24       | 16            | 2         | 26       | 54       | 6        | 16    | 10        | 4        | 33       | 0        |
| 1735                   | 2         | 8        | 0        | 16       | 17            | 7         | 6        | 56       | 58       | 17    | 2         | 16       | 5        | 4        |
| 1736                   | 6         | 18       | 3        | 8        | 18            | 11        | 16       | 59       | 50       | 18    | 6         | 27       | 37       | 7        |
| 1737                   | 3         | 9        | 38       | 3        | 19            | 3         | 27       | 2        | 42       | 19    | 11        | 9        | 9        | 11       |
| 1738                   | 7         | 19       | 40       | 55       | 20            | 0         | 18       | 37       | 38       | 20    | 3         | 20       | 41       | 15       |
| 1739                   | 11        | 29       | 43       | 47       | 40            | 1         | 7        | 15       | 16       | 21    | 8         | 2        | 13       | 19       |
| 1740                   | 4         | 9        | 46       | 39       | 60            | 1         | 25       | 52       | 54       | 22    | 0         | 13       | 45       | 22       |
| 1741                   | 1         | 1        | 21       | 35       | 80            | 2         | 14       | 30       | 31       | 23    | 4         | 25       | 17       | 26       |
| 1742                   | 5         | 11       | 24       | 27       | 100           | 3         | 3        | 8        | 9        | 24    | 9         | 6        | 49       | 30       |
| 1743                   | 9         | 21       | 27       | 18       | 200           | 6         | 6        | 16       | 19       | 25    | 1         | 18       | 21       | 34       |
| 1744                   | 2         | 1        | 30       | 10       | 300           | 9         | 9        | 24       | 28       | 26    | 5         | 29       | 53       | 37       |
| 1745                   | 10        | 23       | 5        | 7        | 400           | 0         | 12       | 32       | 37       | 27    | 10        | 11       | 25       | 41       |
| Jan.                   | 0         | 0        | 0        | 0        | 500           | 3         | 15       | 40       | 47       | 28    | 2         | 22       | 57       | 45       |
| Feb.                   | 3         | 27       | 33       | 57       | 600           | 6         | 18       | 48       | 56       | 29    | 7         | 4        | 29       | 49       |
| Mar.                   | 6         | 20       | 31       | 42       | 700           | 9         | 21       | 57       | 5        | 30    | 11        | 16       | 1        | 52       |
| Apr.                   | 10        | 18       | 5        | 39       | 800           | 0         | 25       | 5        | 15       | 31    | 3         | 27       | 33       | 57       |
| May.                   | 10        | 4        | 7        | 31       | 900           | 3         | 28       | 13       | 24       |       |           |          |          |          |
| June                   | 2         | 1        | 41       | 28       | 1000          | 7         | 1        | 21       | 33       |       |           |          |          |          |
| July                   | 1         | 17       | 43       | 20       | 2000          | 2         | 2        | 43       | 6        |       |           |          |          |          |
| Aug.                   | 5         | 15       | 17       | 17       | 3000          | 9         | 4        | 4        | 39       |       |           |          |          |          |
| Sept.                  | 9         | 12       | 51       | 14       | 4000          | 4         | 5        | 26       | 12       |       |           |          |          |          |
| Oct.                   | 8         | 28       | 53       | 6        | 5000          | 11        | 6        | 47       | 45       |       |           |          |          |          |
| Nov.                   | 0         | 26       | 27       | 3        | 6000          | 6         | 8        | 9        | 18       |       |           |          |          |          |
| Dec.                   | 0         | 12       | 28       | 55       | 7000          | 1         | 9        | 30       | 51       |       |           |          |          |          |



# A Table of the Motion of the Second Satellite of Saturn: 85

| H  | Motion. |    |    |    | /   | 0 | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 0 | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   |
|----|---------|----|----|----|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|    | f.      | a  | l  | u  | /// | " | /// | /// | /// | /// | /// | /// | /// | /// | /// | " | /// | /// | /// | /// | /// | /// | /// | /// | /// |
| 1  | 0       | 5  | 28 | 50 | 1   | 0 | 5   | 29  | 31  | 2   | 49  | 55  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 2  | 0       | 10 | 57 | 40 | 2   | 0 | 10  | 58  | 32  | 2   | 55  | 24  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 3  | 0       | 16 | 26 | 30 | 3   | 0 | 16  | 26  | 33  | 3   | 0   | 52  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 4  | 0       | 21 | 55 | 21 | 4   | 0 | 21  | 55  | 34  | 3   | 6   | 20  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 5  | 0       | 27 | 24 | 11 | 5   | 0 | 27  | 24  | 35  | 3   | 11  | 49  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 6  | 1       | 2  | 53 | 1  | 6   | 0 | 32  | 53  | 36  | 3   | 17  | 18  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 7  | 1       | 8  | 21 | 51 | 7   | 0 | 38  | 22  | 37  | 3   | 22  | 47  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 8  | 1       | 13 | 50 | 41 | 8   | 0 | 43  | 51  | 38  | 3   | 28  | 16  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 9  | 1       | 19 | 19 | 31 | 9   | 0 | 49  | 19  | 39  | 3   | 33  | 44  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 10 | 1       | 24 | 48 | 21 | 10  | 0 | 54  | 48  | 40  | 3   | 39  | 14  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 11 | 2       | 0  | 17 | 12 | 11  | 1 | 0   | 17  | 41  | 3   | 44  | 43  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 12 | 2       | 5  | 46 | 2  | 12  | 1 | 5   | 46  | 42  | 3   | 50  | 12  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 13 | 2       | 11 | 14 | 52 | 13  | 1 | 11  | 15  | 43  | 3   | 55  | 41  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 14 | 2       | 16 | 43 | 42 | 14  | 1 | 16  | 44  | 44  | 4   | 1   | 9   |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 15 | 2       | 22 | 12 | 32 | 15  | 1 | 22  | 12  | 45  | 4   | 6   | 36  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 16 | 2       | 27 | 41 | 22 | 16  | 1 | 27  | 41  | 46  | 4   | 12  | 5   |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 17 | 3       | 3  | 10 | 13 | 17  | 1 | 33  | 10  | 47  | 4   | 17  | 34  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 18 | 3       | 8  | 39 | 3  | 18  | 1 | 38  | 39  | 48  | 4   | 23  | 3   |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 19 | 3       | 14 | 7  | 53 | 19  | 1 | 44  | 8   | 49  | 4   | 28  | 32  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 20 | 3       | 19 | 36 | 43 | 20  | 1 | 49  | 38  | 50  | 4   | 34  | 1   |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 21 | 3       | 25 | 5  | 33 | 21  | 1 | 55  | 7   | 51  | 4   | 39  | 29  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 22 | 4       | 0  | 34 | 23 | 22  | 2 | 0   | 35  | 52  | 4   | 44  | 58  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 23 | 4       | 6  | 3  | 13 | 23  | 2 | 6   | 4   | 53  | 4   | 50  | 27  |     |     |     |   |     |     |     |     |     |     |     |     |     |
| 24 | 4       | 11 | 32 | 4  | 24  | 2 | 11  | 33  | 54  | 4   | 55  | 56  |     |     |     |   |     |     |     |     |     |     |     |     |     |
|    |         |    |    |    | 25  | 2 | 17  | 2   | 55  | 5   | 1   | 25  |     |     |     |   |     |     |     |     |     |     |     |     |     |
|    |         |    |    |    | 26  | 2 | 22  | 31  | 56  | 5   | 6   | 54  |     |     |     |   |     |     |     |     |     |     |     |     |     |
|    |         |    |    |    | 27  | 2 | 28  | 0   | 57  | 5   | 12  | 22  |     |     |     |   |     |     |     |     |     |     |     |     |     |
|    |         |    |    |    | 28  | 2 | 33  | 28  | 58  | 5   | 17  | 51  |     |     |     |   |     |     |     |     |     |     |     |     |     |
|    |         |    |    |    | 29  | 2 | 38  | 57  | 59  | 5   | 23  | 20  |     |     |     |   |     |     |     |     |     |     |     |     |     |
|    |         |    |    |    | 30  | 2 | 44  | 26  | 60  | 5   | 28  | 50  |     |     |     |   |     |     |     |     |     |     |     |     |     |

In Leap-Year, after *February*, add the Motion of a Day more to the rest.

Its Nodes are in  $\text{♊}$   $\times$   $21^\circ$ . Inclination  $31^\circ$ .

The Epoche of this Satellite I have taken, *Anno* 1713, December 31 at Noon,  $\text{h}$  Geocentric Place was then  $55^\circ 31' 6'' 9''$ .

86 A Table of the Motion of the third Satellite of Saturn.

| Years<br>Cur-<br>rent | Motion.                              | Years<br>Com. | Motion.                              | Days. | Motion.                              |
|-----------------------|--------------------------------------|---------------|--------------------------------------|-------|--------------------------------------|
|                       | <i>f.</i> <i>°</i> <i>'</i> <i>"</i> |               | <i>f.</i> <i>°</i> <i>'</i> <i>"</i> |       | <i>f.</i> <i>°</i> <i>'</i> <i>"</i> |
| 1681                  | 5 4 23 10                            | 1             | 9 17 2 0                             | 1     | 2 19 41 26                           |
| 1701                  | 5 23 30 23                           | 2             | 7 4 4 0                              | 2     | 5 9 22 52                            |
| 1721                  | 6 12 37 36                           | 3             | 4 21 6 0                             | 3     | 7 29 4 17                            |
| 1722                  | 3 29 39 36                           | 4             | 4 27 49 26                           | 4     | 10 18 45 43                          |
| 1723                  | 1 16 41 36                           | 5             | 2 14 51 25                           | 5     | 1 8 27 9                             |
| 1724                  | 11 3 43 36                           | 6             | 0 1 53 27                            | 6     | 3 28 8 35                            |
| 1725                  | 11 10 27 2                           | 7             | 9 18 55 27                           | 7     | 6 17 50 1                            |
| 1726                  | 8 27 29 2                            | 8             | 9 25 38 53                           | 8     | 9 7 31 26                            |
| 1727                  | 6 14 32 3                            | 9             | 7 12 40 53                           | 9     | 11 27 12 52                          |
| 1728                  | 4 1 33 3                             | 10            | 4 29 42 53                           | 10    | 2 16 54 18                           |
| 1729                  | 4 8 16 29                            | 11            | 2 16 44 53                           | 11    | 5 6 35 44                            |
| 1730                  | 1 25 18 29                           | 12            | 2 23 28 19                           | 12    | 7 26 17 10                           |
| 1731                  | 11 12 20 29                          | 13            | 0 10 30 20                           | 13    | 10 15 58 35                          |
| 1732                  | 8 29 22 29                           | 14            | 9 27 32 20                           | 14    | 1 5 40 1                             |
| 1733                  | 9 6 5 55                             | 15            | 7 14 34 20                           | 15    | 3 25 21 27                           |
| 1734                  | 6 23 7 55                            | 16            | 7 21 17 46                           | 16    | 6 15 2 53                            |
| 1735                  | 4 10 9 55                            | 17            | 5 8 19 46                            | 17    | 9 4 44 19                            |
| 1736                  | 1 27 11 56                           | 18            | 2 25 21 46                           | 18    | 11 24 25 44                          |
| 1737                  | 2 3 55 22                            | 19            | 0 12 23 46                           | 19    | 2 14 7 10                            |
| 1738                  | 11 20 57 22                          | 20            | 0 19 7 13                            | 20    | 5 3 48 36                            |
| 1739                  | 9 7 59 22                            | 40            | 1 8 14 25                            | 21    | 7 23 30 2                            |
| 1740                  | 6 25 1 22                            | 60            | 1 27 21 38                           | 22    | 10 13 11 28                          |
| 1741                  | 7 1 44 48                            | 80            | 2 16 28 51                           | 23    | 1 2 52 53                            |
| 1742                  | 4 18 46 48                           | 100           | 3 5 36 3                             | 24    | 3 22 34 19                           |
| 1743                  | 2 5 48 48                            | 200           | 6 11 12 7                            | 25    | 6 12 15 45                           |
| 1744                  | 11 22 50 49                          | 300           | 9 16 48 10                           | 26    | 9 1 57 11                            |
| 1745                  | 11 29 34 15                          | 400           | 0 22 24 13                           | 27    | 11 21 38 37                          |
| Jan.                  | 0 0 0 0                              | 500           | 3 28 0 17                            | 28    | 2 11 20 2                            |
| Feb.                  | 10 10 24 20                          | 600           | 7 3 36 20                            | 29    | 5 1 1 28                             |
| Mar.                  | 0 21 44 22                           | 700           | 10 9 12 23                           | 30    | 7 20 42 54                           |
| Apr.                  | 11 2 8 43                            | 800           | 1 14 48 27                           | 31    | 10 10 24 20                          |
| May                   | 6 22 51 37                           | 900           | 4 20 24 30                           |       |                                      |
| June                  | 5 3 15 57                            | 1000          | 7 26 0 23                            |       |                                      |
| July                  | 0 23 58 51                           | 2000          | 3 22 1 6                             |       |                                      |
| Aug.                  | 11 4 23 11                           | 3000          | 7 14 2 12                            |       |                                      |
| Sept.                 | 9 14 47 31                           | 4000          | 3 10 2 45                            |       |                                      |
| Oct.                  | 5 5 30 25                            | 5000          | 11 6 3 18                            |       |                                      |
| Nov.                  | 3 15 54 45                           | 6000          | 7 2 3 51                             |       |                                      |
| Dec.                  | 11 6 37 39                           | 7000          | 2 28 4 24                            |       |                                      |

A Table of the Motion of the third Satellite of Saturn. 87

| H. | Motion. |    |    |     | /  | ° | '  | "   | /  | ° | '  | "   |
|----|---------|----|----|-----|----|---|----|-----|----|---|----|-----|
|    | °       | '  | "  | ''' |    | ° | '  | ''' |    | ° | '  | ''' |
| 1  | 0       | 3  | 19 | 14  | 1  | 0 | 3  | 19  | 31 | 1 | 42 | 56  |
| 2  | 0       | 6  | 38 | 27  | 2  | 0 | 6  | 38  | 32 | 1 | 46 | 15  |
| 3  | 0       | 9  | 57 | 41  | 3  | 0 | 9  | 58  | 33 | 1 | 49 | 34  |
| 4  | 0       | 13 | 16 | 54  | 4  | 0 | 13 | 17  | 34 | 1 | 52 | 53  |
| 5  | 0       | 16 | 36 | 8   | 5  | 0 | 16 | 36  | 35 | 1 | 56 | 13  |
| 6  | 0       | 19 | 55 | 21  | 6  | 0 | 19 | 55  | 36 | 1 | 59 | 32  |
| 7  | 0       | 23 | 14 | 35  | 7  | 0 | 23 | 15  | 37 | 2 | 2  | 51  |
| 8  | 0       | 26 | 33 | 49  | 8  | 0 | 26 | 34  | 38 | 2 | 6  | 10  |
| 9  | 0       | 29 | 53 | 2   | 9  | 0 | 29 | 53  | 39 | 2 | 9  | 29  |
| 10 | 1       | 3  | 12 | 16  | 10 | 0 | 33 | 12  | 40 | 2 | 12 | 49  |
| 11 | 1       | 6  | 31 | 29  | 11 | 0 | 36 | 31  | 41 | 2 | 16 | 8   |
| 12 | 1       | 9  | 50 | 43  | 12 | 0 | 39 | 51  | 42 | 2 | 19 | 27  |
| 13 | 1       | 13 | 9  | 56  | 13 | 0 | 43 | 10  | 43 | 2 | 22 | 46  |
| 14 | 1       | 16 | 29 | 10  | 14 | 0 | 46 | 29  | 44 | 2 | 26 | 6   |
| 15 | 1       | 19 | 48 | 23  | 15 | 0 | 49 | 48  | 45 | 2 | 29 | 25  |
| 16 | 1       | 23 | 7  | 37  | 16 | 0 | 53 | 7   | 46 | 2 | 32 | 44  |
| 17 | 1       | 26 | 26 | 51  | 17 | 0 | 56 | 27  | 47 | 2 | 36 | 3   |
| 18 | 1       | 29 | 46 | 4   | 18 | 0 | 59 | 46  | 48 | 2 | 39 | 22  |
| 19 | 2       | 3  | 5  | 18  | 19 | 1 | 3  | 5   | 49 | 2 | 42 | 42  |
| 20 | 2       | 6  | 24 | 31  | 20 | 1 | 6  | 24  | 50 | 2 | 46 | 1   |
| 21 | 2       | 9  | 43 | 45  | 21 | 1 | 9  | 44  | 51 | 2 | 49 | 20  |
| 22 | 2       | 13 | 2  | 58  | 22 | 1 | 13 | 3   | 52 | 2 | 52 | 39  |
| 23 | 2       | 16 | 22 | 12  | 23 | 1 | 16 | 22  | 53 | 2 | 55 | 58  |
| 24 | 2       | 19 | 41 | 26  | 24 | 1 | 19 | 41  | 54 | 2 | 59 | 18  |
| 25 |         |    |    |     | 25 | 1 | 23 | 0   | 55 | 3 | 2  | 37  |
| 26 |         |    |    |     | 26 | 1 | 26 | 20  | 56 | 3 | 5  | 56  |
| 27 |         |    |    |     | 27 | 1 | 29 | 39  | 57 | 3 | 9  | 15  |
| 28 |         |    |    |     | 28 | 1 | 32 | 58  | 58 | 3 | 12 | 35  |
| 29 |         |    |    |     | 29 | 1 | 36 | 17  | 59 | 3 | 15 | 54  |
| 30 |         |    |    |     | 30 | 1 | 39 | 36  | 60 | 3 | 19 | 14  |

In Leap-Year, after February, add the Motion of a Day more to the rest.

Its Nodes are in  $\text{♊}$   $\times$   $21^\circ$ . Inclination  $31^\circ$ .

The Epoche of this Satellite I have taken, Anno 1713, December 31 at Noon,  $\text{h}$  Geocentric Place was then  $5^\circ 11' 6'' 9''$ .



188 A Table of the Motion of the fourth Satellite of Saturn.

| Years | Motion. |    |    |    | Years | Motion. |    |    |    | Days. | Motion. |    |    |    |
|-------|---------|----|----|----|-------|---------|----|----|----|-------|---------|----|----|----|
| Cur-  | f.      | o. | '  | "  | Com.  | f.      | o. | '  | "  |       | f.      | o. | '  | "  |
| 1681  | 1       | 0  | 48 | 56 | 1     | 10      | 20 | 35 | 19 | 1     | 0       | 22 | 34 | 37 |
| 1701  | 2       | 15 | 28 | 19 | 2     | 9       | 11 | 10 | 37 | 2     | 1       | 15 | 9  | 14 |
| 1721  | 4       | 0  | 7  | 42 | 3     | 8       | 1  | 45 | 56 | 3     | 2       | 7  | 43 | 51 |
| 1722  | 2       | 20 | 43 | 1  | 4     | 7       | 14 | 55 | 52 | 4     | 3       | 0  | 18 | 48 |
| 1723  | 1       | 11 | 18 | 20 | 5     | 6       | 5  | 31 | 11 | 5     | 3       | 22 | 53 | 5  |
| 1724  | 0       | 1  | 53 | 39 | 6     | 4       | 26 | 6  | 30 | 6     | 4       | 15 | 27 | 42 |
| 1725  | 11      | 15 | 3  | 35 | 7     | 3       | 16 | 41 | 49 | 7     | 5       | 8  | 2  | 19 |
| 1726  | 10      | 5  | 38 | 54 | 8     | 2       | 29 | 51 | 45 | 8     | 6       | 0  | 36 | 56 |
| 1727  | 8       | 26 | 14 | 13 | 9     | 1       | 20 | 27 | 4  | 9     | 6       | 23 | 11 | 33 |
| 1728  | 7       | 16 | 49 | 31 | 10    | 0       | 11 | 2  | 23 | 10    | 7       | 15 | 46 | 10 |
| 1729  | 6       | 29 | 59 | 27 | 11    | 11      | 1  | 37 | 42 | 11    | 8       | 8  | 20 | 47 |
| 1730  | 5       | 20 | 34 | 46 | 12    | 10      | 14 | 47 | 38 | 12    | 9       | 0  | 55 | 24 |
| 1731  | 4       | 11 | 10 | 5  | 13    | 9       | 5  | 22 | 57 | 13    | 9       | 23 | 30 | 1  |
| 1732  | 5       | 1  | 45 | 24 | 14    | 7       | 25 | 38 | 15 | 14    | 10      | 16 | 4  | 38 |
| 1733  | 2       | 14 | 55 | 20 | 15    | 6       | 16 | 33 | 34 | 15    | 11      | 8  | 39 | 15 |
| 1734  | 1       | 5  | 30 | 39 | 16    | 5       | 29 | 43 | 30 | 16    | 0       | 1  | 13 | 52 |
| 1735  | 11      | 26 | 5  | 58 | 17    | 4       | 20 | 18 | 49 | 17    | 0       | 23 | 48 | 29 |
| 1736  | 10      | 16 | 41 | 17 | 18    | 3       | 10 | 54 | 8  | 18    | 1       | 16 | 23 | 6  |
| 1737  | 10      | 29 | 51 | 13 | 19    | 2       | 1  | 29 | 27 | 19    | 2       | 8  | 57 | 43 |
| 1738  | 9       | 20 | 26 | 31 | 20    | 1       | 14 | 39 | 23 | 20    | 3       | 1  | 32 | 20 |
| 1739  | 8       | 11 | 1  | 50 | 40    | 2       | 29 | 18 | 46 | 21    | 3       | 24 | 6  | 57 |
| 1740  | 7       | 1  | 37 | 9  | 60    | 4       | 13 | 58 | 9  | 22    | 4       | 16 | 41 | 34 |
| 1741  | 5       | 14 | 47 | 5  | 80    | 5       | 28 | 37 | 32 | 23    | 5       | 9  | 16 | 11 |
| 1742  | 4       | 5  | 22 | 24 | 100   | 7       | 13 | 16 | 55 | 24    | 6       | 1  | 50 | 48 |
| 1743  | 2       | 25 | 57 | 43 | 200   | 2       | 26 | 33 | 50 | 25    | 6       | 24 | 25 | 25 |
| 1744  | 1       | 16 | 33 | 2  | 300   | 10      | 9  | 50 | 44 | 26    | 7       | 17 | 0  | 2  |
| 1745  | 0       | 29 | 42 | 58 | 400   | 5       | 23 | 7  | 39 | 27    | 8       | 9  | 34 | 39 |
| Jan.  | 0       | 0  | 0  | 0  | 500   | 1       | 6  | 24 | 34 | 28    | 9       | 2  | 9  | 16 |
| Feb.  | 11      | 9  | 53 | 8  | 600   | 8       | 19 | 44 | 29 | 29    | 9       | 24 | 43 | 53 |
| Mar.  | 8       | 12 | 2  | 26 | 700   | 4       | 2  | 58 | 24 | 30    | 10      | 17 | 18 | 32 |
| Apr.  | 7       | 21 | 55 | 34 | 800   | 11      | 16 | 15 | 19 | 31    | 11      | 9  | 53 | 8  |
| May   | 6       | 9  | 14 | 6  | 900   | 6       | 29 | 32 | 13 |       |         |    |    |    |
| June  | 5       | 19 | 7  | 14 | 1000  | 2       | 12 | 49 | 8  |       |         |    |    |    |
| July  | 4       | 6  | 25 | 40 | 2000  | 4       | 25 | 38 | 16 |       |         |    |    |    |
| Aug.  | 3       | 16 | 18 | 54 | 3000  | 7       | 8  | 27 | 24 |       |         |    |    |    |
| Sept. | 2       | 26 | 12 | 24 | 4000  | 9       | 21 | 16 | 32 |       |         |    |    |    |
| Oct.  | 1       | 13 | 30 | 34 | 5000  | 0       | 4  | 5  | 40 |       |         |    |    |    |
| Nov.  | 0       | 23 | 23 | 42 | 6000  | 2       | 16 | 54 | 48 |       |         |    |    |    |
| Dec.  | 11      | 10 | 42 | 14 | 7000  | 4       | 29 | 43 | 56 |       |         |    |    |    |

# Table of the Motion of the fourth Satellite of Saturn.

| H. | 0  | 1  | 2   | H. | 0  | 1  | 2   |
|----|----|----|-----|----|----|----|-----|
| 1  | 1  | 11 | 111 | 1  | 1  | 11 | 111 |
| 2  | 2  | 22 | 222 | 2  | 2  | 22 | 222 |
| 1  | 0  | 56 | 27  | 31 | 49 | 9  | 43  |
| 2  | 1  | 52 | 53  | 32 | 30 | 6  | 9   |
| 3  | 2  | 49 | 20  | 33 | 31 | 2  | 36  |
| 4  | 3  | 45 | 46  | 34 | 31 | 59 | 2   |
| 5  | 4  | 42 | 13  | 35 | 32 | 55 | 29  |
| 6  | 5  | 38 | 39  | 36 | 33 | 51 | 55  |
| 7  | 6  | 35 | 6   | 37 | 34 | 48 | 22  |
| 8  | 7  | 31 | 32  | 38 | 35 | 44 | 48  |
| 9  | 8  | 27 | 59  | 39 | 36 | 41 | 15  |
| 10 | 9  | 24 | 25  | 40 | 37 | 37 | 41  |
| 11 | 10 | 20 | 52  | 41 | 38 | 34 | 8   |
| 12 | 11 | 17 | 18  | 42 | 39 | 30 | 34  |
| 13 | 12 | 13 | 45  | 43 | 40 | 27 | 1   |
| 14 | 13 | 10 | 11  | 44 | 41 | 23 | 27  |
| 15 | 14 | 6  | 38  | 45 | 42 | 19 | 54  |
| 16 | 15 | 3  | 5   | 46 | 43 | 16 | 21  |
| 17 | 15 | 59 | 31  | 47 | 44 | 12 | 47  |
| 18 | 16 | 55 | 58  | 48 | 45 | 9  | 14  |
| 19 | 17 | 52 | 24  | 49 | 46 | 5  | 40  |
| 20 | 18 | 48 | 51  | 50 | 47 | 2  | 7   |
| 21 | 19 | 45 | 17  | 51 | 47 | 58 | 33  |
| 22 | 20 | 41 | 44  | 52 | 48 | 55 | 0   |
| 23 | 21 | 38 | 10  | 53 | 49 | 51 | 26  |
| 24 | 22 | 34 | 37  | 54 | 50 | 47 | 53  |
| 25 | 23 | 31 | 3   | 55 | 51 | 44 | 19  |
| 26 | 24 | 27 | 30  | 56 | 52 | 40 | 46  |
| 27 | 25 | 23 | 56  | 57 | 53 | 37 | 12  |
| 28 | 26 | 20 | 23  | 58 | 54 | 33 | 39  |
| 29 | 27 | 16 | 49  | 59 | 55 | 30 | 5   |
| 30 | 28 | 13 | 16  | 60 | 56 | 26 | 32  |

In Leap-Year, after February, add the Motion of a Day more to the rest.

Its Nodes are in  $\text{♊}$   $\times$   $21^\circ$ . Inclination  $31^\circ$ .

The Epoche of this Satellite I have taken, Anno 1713, December 31 at Noon.  $\frac{1}{2}$  Geocentric Place was then  $5^\circ 11' 6'' 9''$ .

90 A Table of the Motion of the fifth Satellite of Saturn.

| Years<br>Cur-<br>rent. | Motion.     | Years<br>Com. | Motion.     | Days. | Motion.    |
|------------------------|-------------|---------------|-------------|-------|------------|
|                        | f. o ' "    |               | f. o ' "    |       | f. o ' "   |
| 1681                   | 0 9 20 39   | 1             | 7 6 30 20   | 1     | 0 4 32 18  |
| 1701                   | 1 12 8 47   | 2             | 2 13 0 40   | 2     | 0 9 4 36   |
| 1721                   | 2 14 56 55  | 3             | 9 19 31 0   | 3     | 0 13 36 54 |
| 1722                   | 9 21 27 15  | 4             | 5 0 33 38   | 4     | 0 18 9 13  |
| 1723                   | 4 27 57 35  | 5             | 0 7 3 58    | 5     | 0 22 41 31 |
| 1724                   | 0 4 27 55   | 6             | 7 13 34 17  | 6     | 0 27 13 49 |
| 1725                   | 7 15 30 33  | 7             | 2 20 4 37   | 7     | 1 1 46 7   |
| 1726                   | 2 22 0 53   | 8             | 10 1 7 15   | 8     | 1 6 18 25  |
| 1727                   | 9 28 31 13  | 9             | 5 7 37 35   | 9     | 1 10 50 43 |
| 1728                   | 5 5 1 33    | 10            | 0 14 7 55   | 10    | 1 15 23 1  |
| 1729                   | 0 16 4 11   | 11            | 7 20 38 15  | 11    | 1 19 55 19 |
| 1730                   | 7 22 34 31  | 12            | 3 1 40 53   | 12    | 1 24 27 38 |
| 1731                   | 2 29 4 51   | 13            | 10 8 11 13  | 13    | 1 28 59 56 |
| 1732                   | 10 5 35 11  | 14            | 5 14 41 33  | 14    | 2 3 32 14  |
| 1733                   | 5 16 37 49  | 15            | 0 21 11 53  | 15    | 2 8 4 32   |
| 1734                   | 0 23 8 8    | 16            | 8 2 14 31   | 16    | 2 12 36 50 |
| 1735                   | 7 29 38 28  | 17            | 3 8 44 51   | 17    | 2 17 9 8   |
| 1736                   | 3 6 8 48    | 18            | 10 15 15 10 | 18    | 2 21 41 26 |
| 1737                   | 10 17 11 26 | 19            | 5 21 45 30  | 19    | 2 26 13 45 |
| 1738                   | 5 23 41 46  | 20            | 1 2 48 8    | 20    | 3 0 46 3   |
| 1739                   | 1 0 12 6    | 40            | 2 5 36 17   | 21    | 3 5 18 21  |
| 1740                   | 8 6 42 26   | 60            | 3 8 24 25   | 22    | 3 9 50 39  |
| 1741                   | 3 17 45 4   | 80            | 4 11 12 34  | 23    | 3 14 22 57 |
| 1742                   | 10 24 15 24 | 100           | 5 14 0 42   | 24    | 3 18 55 15 |
| 1743                   | 6 0 45 44   | 200           | 10 28 1 24  | 25    | 3 23 27 33 |
| 1744                   | 1 7 16 4    | 300           | 4 12 2 6    | 26    | 3 27 59 51 |
| 1745                   | 8 18 18 42  | 400           | 9 26 2 48   | 27    | 4 2 32 10  |
| Jan.                   | 0 0 0 0     | 500           | 3 10 3 30   | 28    | 4 7 4 28   |
| Feb.                   | 4 20 41 22  | 600           | 8 24 4 12   | 29    | 4 11 36 46 |
| Mar.                   | 8 27 45 50  | 700           | 2 8 4 55    | 30    | 4 16 9 4   |
| Apr.                   | 1 18 27 12  | 800           | 7 22 5 37   | 31    | 4 20 41 22 |
| May                    | 6 4 36 16   | 900           | 1 6 6 19    |       |            |
| June                   | 10 25 17 38 | 1000          | 6 20 7 1    |       |            |
| July                   | 3 11 26 42  | 2000          | 1 10 14 2   |       |            |
| Aug.                   | 8 2 8 5     | 3000          | 8 0 21 3    |       |            |
| Sept.                  | 0 22 49 27  | 4000          | 2 20 28 4   |       |            |
| Oct.                   | 5 8 58 31   | 5000          | 9 10 35 5   |       |            |
| Nov.                   | 9 29 39 53  | 6000          | 4 0 42 6    |       |            |
| Dec.                   | 2 15 48 57  | 7000          | 10 20 49 7  |       |            |



# A Table of the Motion of the fifth Satellite of *Saturn*. 91

| H. | o | '   | "   | H. | o  | '   | "   |
|----|---|-----|-----|----|----|-----|-----|
| 1  | 1 | "   | /// | 1  | 1  | "   | /// |
| 2  | " | /// | /// | 2  | "  | /// | /// |
| 3  | 0 | 11  | 21  | 31 | 5  | 51  | 43  |
| 4  | 0 | 22  | 41  | 32 | 6  | 3   | 4   |
| 5  | 0 | 34  | 2   | 33 | 6  | 14  | 25  |
| 6  | 0 | 45  | 23  | 34 | 6  | 25  | 45  |
| 7  | 0 | 56  | 44  | 35 | 6  | 37  | 6   |
| 8  | 1 | 8   | 4   | 36 | 6  | 48  | 27  |
| 9  | 1 | 19  | 25  | 37 | 6  | 59  | 48  |
| 10 | 1 | 30  | 46  | 38 | 7  | 11  | 8   |
| 11 | 1 | 42  | 7   | 39 | 7  | 22  | 29  |
| 12 | 1 | 53  | 27  | 40 | 7  | 33  | 50  |
| 13 | 2 | 4   | 48  | 41 | 7  | 45  | 11  |
| 14 | 2 | 16  | 9   | 42 | 7  | 56  | 31  |
| 15 | 2 | 27  | 30  | 43 | 8  | 7   | 52  |
| 16 | 2 | 38  | 50  | 44 | 8  | 19  | 13  |
| 17 | 2 | 50  | 11  | 45 | 8  | 30  | 34  |
| 18 | 3 | 1   | 32  | 46 | 8  | 41  | 54  |
| 19 | 3 | 12  | 53  | 47 | 8  | 53  | 15  |
| 20 | 3 | 24  | 13  | 48 | 9  | 4   | 36  |
| 21 | 3 | 35  | 34  | 49 | 9  | 15  | 57  |
| 22 | 3 | 46  | 55  | 50 | 9  | 27  | 17  |
| 23 | 3 | 58  | 16  | 51 | 9  | 38  | 38  |
| 24 | 4 | 9   | 36  | 52 | 9  | 49  | 59  |
| 25 | 4 | 20  | 57  | 53 | 10 | 1   | 20  |
| 26 | 4 | 32  | 18  | 54 | 10 | 12  | 40  |
| 27 | 4 | 43  | 39  | 55 | 10 | 24  | 1   |
| 28 | 4 | 54  | 59  | 56 | 10 | 35  | 22  |
| 29 | 5 | 6   | 20  | 57 | 10 | 46  | 43  |
| 30 | 5 | 17  | 41  | 58 | 10 | 53  | 3   |
|    | 5 | 29  | 2   | 59 | 11 | 9   | 24  |
|    | 5 | 40  | 22  | 60 | 11 | 20  | 45  |

In Leap-Year, after *February*, add the Motion of a Day more to the rest.

Its Nodes are in  $\text{♊} \times 4^\circ$ . Inclination  $16^\circ$ .

The Epoche of this Satellite I have taken, *Anno* 1713, *December* 31 at Noon.  $\text{h}$  Geocentric Place was then  $55^\circ 11' 6'' 9''$ .

A Table of the Distances of *Saturn's* Satellites, from his Body in Semidiameters and Decimal Parts of his Globe.

| Satellite 1. |        |        |         | Satellite 2. |           |        |         | Satellite 3. |           |        |         |
|--------------|--------|--------|---------|--------------|-----------|--------|---------|--------------|-----------|--------|---------|
| 0            | Con. 1 | Con. 2 | Con. 0  | 0            | Con. 1    | Con. 2 | Con. 0  | 0            | Con. 1    | Con. 2 | Con. 0  |
| 6            | Ant. 7 | Ant. 8 | Ant. 0  | 6            | Ant. 7    | Ant. 8 | Ant. 0  | 6            | Ant. 7    | Ant. 8 | Ant. 0  |
| 0            | 0.0000 | 1.446  | 2.892   | 30           | 0.0000    | 1.853  | 3.706   | 30           | 0.0000    | 2.5881 | 5.1762  |
| 30           | 0.1446 | 1.5906 | 3.0366  | 27           | 3.0.1853  | 2.0383 | 3.8913  | 27           | 3.0.2588  | 2.847  | 5.435   |
| 60           | 0.2892 | 1.7352 | 3.1812  | 24           | 6.0.3706  | 2.2236 | 4.0766  | 24           | 6.0.5176  | 3.1057 | 5.6938  |
| 90           | 0.4338 | 1.8798 | 3.3258  | 21           | 9.0.5559  | 2.4089 | 4.2619  | 21           | 9.0.7764  | 3.3645 | 5.9526  |
| 120          | 0.5784 | 2.0244 | 3.4704  | 18           | 12.0.7412 | 2.5942 | 4.4472  | 18           | 12.1.0352 | 3.6233 | 6.2114  |
| 150          | 0.723  | 2.169  | 3.615   | 15           | 15.0.9265 | 2.7795 | 4.6325  | 15           | 15.1.2940 | 3.8821 | 6.4702  |
| 180          | 0.8676 | 2.3136 | 3.7596  | 12           | 18.1.1118 | 2.9648 | 4.8178  | 12           | 18.1.5529 | 4.141  | 6.7291  |
| 210          | 1.0122 | 2.4582 | 3.9042  | 9            | 21.1.2971 | 3.1501 | 5.0031  | 9            | 21.1.8117 | 4.3998 | 6.9879  |
| 240          | 1.1568 | 2.6028 | 4.0488  | 6            | 24.1.4824 | 3.3354 | 5.1184  | 6            | 24.2.0705 | 4.6586 | 7.2467  |
| 270          | 1.3014 | 2.7474 | 4.1934  | 3            | 27.1.6677 | 3.5207 | 5.3137  | 3            | 27.2.3293 | 4.9174 | 7.5055  |
| 300          | 1.446  | 2.892  | 4.34    | 0            | 30.1.853  | 3.706  | 5.5193  | 0            | 30.2.5881 | 4.1762 | 7.7643  |
| 5            | Con. 4 | Con. 3 | Con. 11 | 5            | Con. 4    | Con. 3 | Con. 11 | 5            | Con. 4    | Con. 3 | Con. 11 |
| Ant. 10      | Ant. 9 | Ant. 9 | Ant. 9  | Ant. 10      | Ant. 9    | Ant. 9 | Ant. 9  | Ant. 10      | Ant. 9    | Ant. 9 | Ant. 9  |

A Table of the Distances of the Satellites of Saturn from his Body, in Semidiameters and Decimal Parts of his Globe.

| Satellite 4.                  |         |         |         |      |
|-------------------------------|---------|---------|---------|------|
| 0                             | Conseq. | 1       | Conseq. | 2    |
| 6                             | Antec.  | 7       | Antec.  | 8    |
| 0                             | 0.0000  | 6.      |         | 12.  |
| 3                             | 0.6     | 6.6     |         | 12.6 |
| 6                             | 1.2     | 7.2     |         | 13.2 |
| 9                             | 1.8     | 7.8     |         | 13.8 |
| 12                            | 2.4     | 8.4     |         | 14.4 |
| 15                            | 3.      | 9.      |         | 15.  |
| 18                            | 3.6     | 9.6     |         | 15.6 |
| 21                            | 4.2     | 10.2    |         | 16.2 |
| 24                            | 4.8     | 10.8    |         | 16.8 |
| 27                            | 5.4     | 11.4    |         | 17.4 |
| 30                            | 6.      | 12.     |         | 18.  |
| Satellite 5.                  |         |         |         |      |
| 0                             | 0.0000  | 17.4859 | 34.9719 | 30   |
| 3                             | 1.7486  | 19.2345 | 36.7205 | 27   |
| 6                             | 3.4972  | 20.9831 | 38.469  | 24   |
| 9                             | 5.2458  | 22.7317 | 40.2176 | 21   |
| 12                            | 6.9944  | 24.4803 | 41.9662 | 18   |
| 15                            | 8.743   | 26.2289 | 43.7148 | 15   |
| 18                            | 10.4916 | 27.9775 | 45.4634 | 12   |
| 21                            | 12.2402 | 29.7261 | 47.212  | 9    |
| 24                            | 13.9887 | 31.4747 | 48.9606 | 6    |
| 27                            | 15.7373 | 33.2233 | 50.7092 | 3    |
| 30                            | 17.4859 | 34.9719 | 52.4578 | 0    |
| 5 Conseq. 4 Conseq. 3 Conseq. |         |         |         |      |
| 11 Antec. 10 Antec. 9 Antec.  |         |         |         |      |



A Table of the Number of Days from the first of  
January to any Day in the Year.

| Days. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|-------|------|------|------|------|-----|------|------|------|-------|------|------|------|
| 1     | 1    | 32   | 60   | 91   | 121 | 152  | 182  | 213  | 244   | 274  | 305  | 335  |
| 2     | 2    | 33   | 61   | 92   | 122 | 153  | 183  | 214  | 245   | 275  | 306  | 336  |
| 3     | 3    | 34   | 62   | 93   | 123 | 154  | 184  | 215  | 246   | 276  | 307  | 337  |
| 4     | 4    | 35   | 63   | 94   | 124 | 155  | 185  | 216  | 247   | 277  | 308  | 338  |
| 5     | 5    | 36   | 64   | 95   | 125 | 156  | 186  | 217  | 248   | 278  | 309  | 339  |
| 6     | 6    | 37   | 65   | 96   | 126 | 157  | 187  | 218  | 249   | 279  | 310  | 340  |
| 7     | 7    | 38   | 66   | 97   | 127 | 158  | 188  | 219  | 250   | 280  | 311  | 341  |
| 8     | 8    | 39   | 67   | 98   | 128 | 159  | 189  | 220  | 251   | 281  | 312  | 342  |
| 9     | 9    | 40   | 68   | 99   | 129 | 160  | 190  | 221  | 252   | 282  | 313  | 343  |
| 10    | 10   | 41   | 69   | 100  | 130 | 161  | 191  | 222  | 253   | 283  | 314  | 344  |
| 11    | 11   | 42   | 70   | 101  | 131 | 162  | 192  | 223  | 254   | 284  | 315  | 345  |
| 12    | 12   | 43   | 71   | 102  | 132 | 163  | 193  | 224  | 255   | 285  | 316  | 346  |
| 13    | 13   | 44   | 72   | 103  | 133 | 164  | 194  | 225  | 256   | 286  | 317  | 347  |
| 14    | 14   | 45   | 73   | 104  | 134 | 165  | 195  | 226  | 257   | 287  | 318  | 348  |
| 15    | 15   | 46   | 74   | 105  | 135 | 166  | 196  | 227  | 258   | 288  | 319  | 349  |
| 16    | 16   | 47   | 75   | 106  | 136 | 167  | 197  | 228  | 259   | 289  | 320  | 350  |
| 17    | 17   | 48   | 76   | 107  | 137 | 168  | 198  | 229  | 260   | 290  | 321  | 351  |
| 18    | 18   | 49   | 77   | 108  | 138 | 169  | 199  | 230  | 261   | 291  | 322  | 352  |
| 19    | 19   | 50   | 78   | 109  | 139 | 170  | 200  | 231  | 262   | 292  | 323  | 353  |
| 20    | 20   | 51   | 79   | 110  | 140 | 171  | 201  | 232  | 263   | 293  | 324  | 354  |
| 21    | 21   | 52   | 80   | 111  | 141 | 172  | 202  | 233  | 264   | 294  | 325  | 355  |
| 22    | 22   | 53   | 81   | 112  | 142 | 173  | 203  | 234  | 265   | 295  | 326  | 356  |
| 23    | 23   | 54   | 82   | 113  | 143 | 174  | 204  | 235  | 266   | 296  | 327  | 357  |
| 24    | 24   | 55   | 83   | 114  | 144 | 175  | 205  | 236  | 267   | 297  | 328  | 358  |
| 25    | 25   | 56   | 84   | 115  | 145 | 176  | 206  | 237  | 268   | 298  | 329  | 359  |
| 26    | 26   | 57   | 85   | 116  | 146 | 177  | 207  | 238  | 269   | 299  | 330  | 360  |
| 27    | 27   | 58   | 86   | 117  | 147 | 178  | 208  | 239  | 270   | 300  | 331  | 361  |
| 28    | 28   | 59   | 87   | 118  | 148 | 179  | 209  | 240  | 271   | 301  | 332  | 362  |
| 29    | 29   | —    | 88   | 119  | 149 | 180  | 210  | 241  | 272   | 302  | 333  | 363  |
| 30    | 30   | —    | 89   | 120  | 150 | 181  | 211  | 242  | 273   | 303  | 334  | 364  |
| 31    | 31   | —    | 90   | —    | 151 | —    | 212  | 243  | —     | 304  | —    | 365  |

**I**N Page 70, I have given you a Table of the Hourly Motions, Apparent Semidiameter, and Horizontal Parallaxes of the Sun and Moon; but you are to observe, that that Table is computed to the middle State of the Lunar Orbit, not having regard to the Change of her Eccentricity: But that you may have these things true at all times, observe the following Method,

*To find the Horizontal Parallax and Apparent Semidiameter of the Moon, according to the Theory.*

*Example.* To the Place of the Moon Jan. 1, 1729, I would know her Horizontal Parallax, and Apparent Semidiameter, which are obtain'd from Figure 2. as follows

*Operation.*

As  $f. \triangle E L F$ , the Ellip. Equat.  $3^{\circ} 4' 38''$  Co-Ar. 1.270174  
 To  $E F$  the Double Eccentricity 90794 - - - 4.958057  
 So  $f. \triangle L F E$ , Mean Anomaly 37 51 52 - - - 9.787897  
 To  $E L$ , Dist.  $\mathcal{D}$  from the Earth 1037834 - - - 6.016128

Now say,

|                                                |       |       |       |          |
|------------------------------------------------|-------|-------|-------|----------|
| As present Dist. $\mathcal{D}$ à $\odot$       | _____ | _____ | _____ | 6.016128 |
| To her mean Distance                           | _____ | _____ | _____ | 6.000000 |
| So $f.$ mean Horizontal Parallax $\mathcal{D}$ | 57'   | 30"   | - -   | 8.223357 |
| To $f.$ present Horizontal Parallax            | 55    | 24    | - -   | 8.207229 |

2. For the Apparent Semidiameter  $\mathcal{D}$  at the same time, say by the Logistical Logarithms,

|                                 |     |     |           |          |
|---------------------------------|-----|-----|-----------|----------|
| As the mean Horizont. Parall.   | 57' | 30" | LL Co-Ar. | 815      |
| To mean Semidiameter            | —   | 15  | 45        | — — 5809 |
| So is the present Horiz. Paral. | 55  | 24  | — — —     | 346      |
|                                 |     |     |           | _____    |
| To the present Apparent Semid.  | 15  | 11  | —         | 5970     |

And after the same manner may you find the Moon's Horizontal Parallax to the second Example, January 2. at Noon 1729, to be  $56' 14''$ , and the Apparent Semidiameter  $15' 24''$ .

For

For the true hourly Motions of the Sun and Moon in Eclipses, &c. calculate their Places to half an Hour before, and to half an Hour after the equal Time of the true Conjunction or Opposition, and so you will gain their true hourly Motions at that time.

N. B. The Table in Page 94, is to be used when you find the Day of the Retrogradation of any Planet by the 11th Precent. of my *Compleat System of Astronomy*.

FINIS

